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THE GEORGE ADLINGTON SYME ORATION.[1]

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THE CULTURE OF HUMAN LIFE.

By J. H. L. CUMPSTON,

Canberra.

THOSE of you who are familiar with Pepys's diary will remember his visit to the Surgeons' Hall on February 26, 1663. Here is his own account:

> Up and to my office, whither several persons came to me about office business. About 11 o'clock Commissioner Pett and I walked to Chyrurgeon's Hall (we being invited thither); where we were led into the Theatre; and by and by comes the reader Dr. Tearne, with the Master and Company, in a very handsome manner; and all being settled, he begun his lecture, this being the second upon the kidneys, ureters, etc., which was very fine; and his discourse being ended, we walked into the Hall, there being great store of company, many doctors of Physique, and we used with extraordinary great respect.

Standing here today, I can feel real sympathy with old Samuel's pride at being treated with great respect by the assembled leaders in the art and science of surgery—and some sympathy with Dr. Tearne at having to deliver an address before a very distingnished and critical audience.

All too incompletely I acknowledge the great honour you have done me in asking me to join with you in keeping warmly alive our memory of one of the great leaders of our profession.

If I pay tribute of reverence to that group of teachers of the Melbourne Medical School who, at the beginning of this century, set for us young men so high a standard of professional and personal integrity, I am not speaking from a narrow local loyalty, but I am expressing a deep personal gratitude.

Among these great men George Syme and his lifelong friend Harry Allen were not least.

There are aspects of the life story of Sir George Syme of which I could speak and of which others have spoken and will speak; but tonight, for this oration, I focus attention on two hours of his life—hours of which I can speak as no one else can.

When Sir George Syme was preparing his presidential address to the Australasian Medical Congress of 1923, he came to my office and asked me in his own simple, direct way: "What should I say about health in relation to medicine?" That, from a senior for whom I had a deep respect, was a startling challenge. I could only give him my views and let him estimate their value. That was the first hour; during the second I listened intently to the address.

[1] Accepted for publication on July 18, 1946.

I believe that I cannot more adequately honour the present occasion than by referring you from time to time to that address. At the same time I would recall that on several occasions during the next two years personal discussions on similar lines occurred and, ultimately, two years later, in 1925, Sir George Syme became Chairman of the Commonwealth Royal Commission of Health. This position involved still further personal relationships in the field of which I propose to speak.

The findings of that Royal Commission have dominated the evolution of the Commonwealth Department of Health; and, my own association with that department having closed, I record, with sincere gratitude, Sir George Syme's wise appreciation of official limitations, his sympathetic personal encouragement, and his undeviating loyalty to the highest ideals of national service. Although a great surgeon, he was, through that commission, an important figure in the public health history of Australia.

All that Sir George Syme said in his presidential address in 1923 is not only true today, but has now even greater force than it then had. He began by quoting Sir Harry Allen thus: "In general terms the medical profession has for its special function the culture of human life." And he then continued: "Probably never was a time in history when the culture of human life was more necessary or important than now, in the period following the Great War."

Let me, for the sake of emphasis, repeat those words, "the medical profession has for its special function the culture of human life".

Note that he was speaking of life, not death: vitality, not morbidity or mortality. "Health"—the word comes from the same Saxon root as heal, hale, whole, holy—it implies at once a unity of body, mind and soul—all working in harmony to ensure unselfconscious happiness. This, surely, is what is meant by the culture of human life.

This high concept of the work of our profession implies much more than diagnosing, prescribing or operating: it involves, amongst other things, the duty of ensuring that every branch of our profession is fully trained and equipped to treat men as well as disease, and that all branches are so organically combined that the profession as a whole can satisfy for the nation this solemn obligation.

It involves more. Under modern conditions, the identity of the individual is being increasingly lost in the organic social body, and the relation of our profession to society is becoming an important aspect of this evolution.

I can speak for only one section of the profession, but my work has given me unique opportunities for observing the impact upon society—as distinct from individuals—of all the other branches; and I have been faced continually with the duty of examining the position of organized medicine in the social system.

The field of "public health" has been steadily expanding and the full significance of the term "medical officer of health" is not generally appreciated. For all working, or talking, purposes, the popular concept was for a long time "medical officer for the prevention of epidemic disease". Strictly speaking, a medical officer of health would have no work to do; in a condition of absolute personal and national health a medical officer would be unnecessary.

A medical officer of health is actually a medical officer whose work is the detection and removal of every factor which encourages or produces conditions of ill health and the development of every factor which encourages positive health. It is clear that he spends his life in the pursuit of an ideal whose "margin fades for ever and for ever" as he moves.

The level of individual health or the quantity of aggregate health is determined by general as well as particular influences. The community, or an individual, may be subject to, but not conscious of, influences which produce greater or smaller changes. Examples of such are transmission of biological racial characteristics, the presumed survival of immune stock or the periodicity of epidemics.

The individual may consciously and intentionally do, or leave undone, things the doing of which affects the state of his health—of such kind are the vices and the inertias.

Social conditions of an infinite variety may, with or without his concurrence, detrimentally affect the environment of any individual or restrict the possibilities of his taking isolated action on his own behalf.

Finally, no individual can possibly have such full knowledge of all possible factors affecting his health as would enable him to remove or to resist adverse conditions.

The complexity of the task of the medical officer of health is, I hope, becoming apparent.

Let me invoke two statements centuries apart. Hippocrates, writing "On Airs, Waters and Places", said:

> Whoever wishes to investigate medicine properly should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces. Then the winds, especially such as are common to all countries. We must also consider the quantities of the waters . . . and the ground whether it be naked and deficient in water . . . and the mode in which the inhabitants live, and what are their pursuits, whether they are fond of drinking and eating to excess and given to indolence . . . From these things he must proceed to investigate everything else.

In 1857, the *Sydney Corporation Act* was passed. This Act includes the earliest definition in Australia which I have been able to find of the functions of a medical officer of health. The Act provides for the appointment of:

> An Officer of Health, who shall be a duly qualified medical practitioner. He shall ascertain the existence and character of diseases especially those deemed epidemic or contagious, and point out any nuisances or other local causes tending to produce, aggravate, or continue such diseases, or otherwise injure the health of the inhabitants, and devise the best means of preventing the spread of such diseases.

Each of these is valid today as a statement of the scope of the lifelong service to which the public health official has consecrated himself; and, clearly, this service has no limit in time or space.

"Causes which otherwise injure the health of the inhabitants" include epidemics, disabilities due to industry, food poisoning, disorders due to overcrowding, to over-indulgence in sport, or other misuse of leisure, and—as Hippocrates puts it—"everything else". But "everything else" includes the ætiology of anæmias of childhood, thyreotoxicosis and cancer, and even, may I say it, of appendicitis.

To some of you this may be a new concept of the duties of the public health official.

If it be contended that this is altogether too wide as a definition of the duties of a health official, then the answer, prompted by long experience, is that under the present democratic parliamentary system, and the tyranny of the public Press, the public health official is expected by his Minister, by parliamentary questions, or by the imperative instructions of a newspaper chief of staff to his reporters, to furnish, on demand, information on almost any conceivable aspect of scientific or social medicine. He must be able to know where reliable information can quickly be obtained, or become a master of *obiter dicta*, or an expert in evasion.

The first duty of the public health official is to equip himself with knowledge. His next duty is to translate that knowledge into some practical

activity which will result in some improvement of the aggregate or individual health. These practical measures are of two kinds: advisory (or educational) and legislative (or administrative).

It is not difficult in these days to obtain knowledge, although constant reading of many journals is necessary. But when the time comes for this knowledge to be used as the basis for official action by governments, a very careful balance of available evidence must be made.

You are probably all familiar with the mass experiments on animals carried out by Topley and Greenwood with the purpose of establishing basic data on the behaviour of infective agents. This was their dictum:

> Our results offer no suggestion that anti-bacterial immunization will (under stated conditions) ameliorate the course of events in an infected herd.

Yet this is inconsistent with a great volume of accumulated practical experience.

When the public health official is asked by his Minister to advise on the inauguration of a tuberculosis campaign, can he quote Brownlee in these terms:

> There is no doubt that a considerable part of the decline of phthisis in recent years is in line with the biological properties of diseases in general and has little to do with hygienic conditions.

He may feel that perhaps Brownlee is right, but he is faced with the grave consideration that, while people are suffering and dying from tuberculosis, he and his government must do some of those things which seem so obviously indicated.

The public health official cannot stop at an academic conclusion based on the evidence; he must give advice which may have quite important consequences for the individual or the community. Under the wartime conditions of the last six years, the responsibility for advising has been a heavy burden; but that is the responsibility of the public health official and he must accept it. In a technical field like this he can share little of the responsibility with his Minister. The final test he must apply is whether it is right for him to advise his government to adopt the procedure he favours, and it is often difficult for him to identify his own inclinations and prejudices and truly assess the part they play in influencing his decision.

The two examples just given and most of the other purely technical matters with which he has to deal are within the field of scientific investigation and the truth will some day be known by patient work; but there is another more complex field. It is necessary to mention only venereal diseases, birth control, decline in the birth rate, to illustrate that, in deciding what advice he must give, the public health official must be more than an impartial scientist—he must know something of men and of those human relationships which confuse the social structure and which find expression in what we know as politics.

This advising of governments is a lonely business, for the official must in the end make his own decision. He may seek the advice of professional friends, but he will find that though in a multitude of medical counsellors there must be wisdom, there is rarely unanimity.

No public health official worthy of his office is content to advise only when requested—he is an idealist, he wishes to see necessary reforms adopted. He is responsible through his government to the people, and it is his duty to formulate with very precise care the nature and extent of the next possible and desirable reforms.

He may be, by natural disposition, inclined to follow Bacon's advice:

> It were good therefore, that Men in their Innovations, would follow the Example of Time it selfe; which indeed Innovateth greatly, but quietly, and by degrees, scarce to be perceived.

Or he may remember the words of Sir Thomas More, the great Utopiast:

> So the case standeth in a Commonwealth; and so it is in the consultations of Kings and Princes. If evil opinions and naughty persuasions can not be utterly and quite plucked out of their hearts; if you can not even as you would remedy vices which use and custom hath confirmed; yet for this cause you must not leave and forsake the Commonwealth; you must not forsake the ship in a tempest, because you can not rule and keep down the winds. No, nor you must not labour to drive into their heads new and strange informations, which you know well shall be nothing regarded with them that be of clean contrary minds. But you must with a crafty wile and a subtle train study and endeavour yourself, inasmuch as in you lieth, to handle the matter wittily and handsomely for the purpose; and that which you cannot turn to good, so to order it that it be not very bad. For it is not possible for all things to be well, unless all men were good: which I think will not be this good many years.

Whatever tactics he adopts, his possibilities are conditioned by four factors: natural laws, national laws, economic laws, public opinion.

Natural laws are obvious enough—genetics are not yet, at least in humans, subject to man's control. Environmental conditions in the tropical coast, in the dry interior and in southern Tasmania all present different problems requiring years of patient research, public education and concerted enterprise.

There is one important natural law with which he has always to contend. I may call it the law of inertia.

Take the case of hydatids. We know that, by comparison with the conditions when I was a medical student, this is now an infection of low incidence. The reduction is due to the work of the medical profession, the activities of the health departments, and to general education. It is a good example of success in the control of a disease. But there were forty years between Davies Thomas and Harold Dew, and still twenty more years after Dew's work had given full clarity and prominence to the subject.

National laws are the ultimate expression of public health reforms suggested by appropriate knowledge. Under this title are included all forms of expression of the people's will by legislation and administration—one of the two methods by which the public health official may see his desired reforms in practical shape. The will of the people is expressed through parliaments and local councils.

In Australia we have two kinds of parliament, Commonwealth and State; and the powers of the Commonwealth Parliament are limited as defined by the Constitution. There is still much confusion of thought about this limitation—perhaps the actions of successive governments have encouraged the confusion. But I am moved to make one clear and simple statement: "There is an Australian nation." I have many times found this incompletely admitted when practical issues were involved. Yet this fact involves for the Commonwealth certain inescapable duties not contemplated in the Constitution, and it will, as time goes on, involve more—with or without changes in the Constitution.

Whatever action has been taken by the Commonwealth Department of Health, and criticized in some quarters as being "outside the Constitution", has been directed to some aspect of national needs and has been no more than an intelligent anticipation of that time when the disjointed Australian communities will honestly admit the truth that they have a joint as well as a several liability.

State parliaments and municipal councils have more clearly defined legal powers, but they too have limitations. Consider these bodies—they are not abstracts; they are groups of men in all respects like ourselves—men placed by our own deliberate choice to do important social service as our delegates.

It is fashionable everywhere, and it is too fashionable in this country, to decry, even to ridicule, politicians. It has, unfortunately, been the public attitude for a very long time.

Remember Hamlet in the graveyard:

> This might be the pate of a politician . . . one that would circumvent God.

Or John Milton:

> This is the masterpiece of a modern politician, how to qualify and mould the sufferance and subjection of the people to the length of the foot that is to tread on their necks: how rapine may serve itself with the fair and honourable pretences of public good: how the puny law may be brought under the wardship and control of lust and will. To be plainer, Sir, how to solder, how to stop a leak, how to keep up the floating carcase of a crazy and diseased monarchy or State, betwixt wind and water, swimming still upon her own dead lees, that is now the deep design of a politician.

This kind of talk cannot be dismissed with the comment that these things were said three hundred years ago. Similar talk can be heard today.

And yet it is all wrong. It is wrong for two reasons.

Firstly, it is false. Members of parliament, as I have known them for forty years of daily contact, are honourable men, earnestly devoted to the interests of their fellow men and conscientious in the performance—often at personal sacrifice—of their national duties. It is true that they are very sensitive to public opinion; but they are there to express the will of the people. It is true that all politics are based on compromise; but that is democratic government. Demos has many tongues and they are not all pentecostal.

Secondly, it is wrong because social progress can be achieved only through legislation or executive acts of government.

The legislation may anticipate or follow public opinion: that is immaterial. What is important is that anyone who wishes to see progress in the culture of human life should have confidence in the elected representatives of the people—a confidence which the whole history of government in Australia justifies, despite occasional aberrations.

I am moved to echo the statement made by Rousseau in the introduction to the "Social Contract":

> I am happy when I reflect upon governments, to find my inquiries always furnish me with new reasons for loving that of my own country.

Ministers are the executive officers of parliament responsible to parliament for everything they do.

I wish to make here grateful acknowledgements to the Ministers under whom I served for their support, encouragement, advice and criticism. When I point out that in the thirty-four years of my service in the Commonwealth Public Service I experienced twenty-six changes of Ministers, it will be obvious that a Minister cannot be expected to acquire personal knowledge of the professional aspects of the work of his department. He should not be expected to do this—his function is to control the policy of the department wherever it affects the public. I feel sure that the Right Honourable W. M. Hughes will not mind my telling this story. When he became Minister for Health, he asked me at the first interview to outline the work of the department and explain what was included in the term "public health". When I had finished he said: "Ah! I get it: you look after the health and I will look after the public."

The public health official must place before the Minister all the facts at his disposal and advise what policy is, in his opinion, the best to adopt in the

interests of the people. The Minister then considers the proposals in the light of all other aspects of government policy and examines them also in their relation to what may be loosely termed political considerations. In the end the proposals are rejected, modified or adopted.

The public health official must do more than this. He must protect his Minister. The rapid dissemination of news, the widespread use of educational techniques of all kinds, which are the modern vogue, bring to the Minister almost daily a stream of requests, suggestions, inquiries, advice, from all sorts of persons. These may come from irrational cranks, they may cover insidiously the possibility of financial gain to interested parties, they may be excellent in theory but difficult in practice, or they may be both excellent and practical but come within Saint Paul's general statement that "all things are lawful, but all things are not expedient".

There are, too, always some persons, including medical men, who, in their enthusiasm for reform, would merit Sir Thomas Browne's caustic comment on the famous Dr. Harvey, that he "being without issue discoursed excellently of Generation".

The weighing of evidence and the giving of advice in matters of this kind are often a difficult problem for the administrative officer. As familiar examples from the past, I would remind you of the Spahlinger and Friedman reputed cures for tuberculosis (we have also some local and recent examples): and from the present the many dietetic and medicinal preparations which are continually being offered by commercial interests.

May I impress upon you that the Minister's task of translating knowledge of natural laws into national laws is always difficult?

There are, moreover, other considerations: both the Minister for Health and the public health official in the pursuit of their ideal of rendering faithful and efficient service to the community are subject to two very powerful influences—economic laws and public opinion, the latter being expressed by the medical profession, the Press and the public itself.

Overshadowing all ideals in the pursuit of the culture of human life are unshakable economic laws. The position can be very simply expressed in four simple and familiar axioms:

Every person agrees that money should be found for all purposes necessary to better health.
Governments can find money only by taxation.
Nobody wishes to pay taxes.
Governments must act in accord with the wishes of the people.

Will you bear with me while I quote Samuel Pepys again? On January 31, 1668, his diary records:

Presently I was called in, where I found the whole number of the Commissioners of the Treasury, and was there received with great respect and kindness; and did give them great satisfaction, making it my endeavour to inform them what it was they were to expect from me, and what was the duty of other people; this being my only way to preserve myself, after all my pains and trouble. They did ask many questions, and demanded other books of me, which I did give them very ready and acceptable answers to; and, upon the whole, I observe they do go about their business like men resolved to go through with it, and in a very good method, like men of understanding.

But one month later, on March 1, he has to make this entry:

Up betimes and to White Hall, there to wait upon the Duke of York and the Commissioners of the Treasury who do declare that they cannot find the money we demand, and we that less than what we demand will not set out the fleet intended, and so broke up, with no other conclusion than that they would let us have what they could get and we would improve that as well as we could. So God bless us, and prepare us against the consequences of these matters.

It is unnecessary to labour the point—money can never be found at any given moment for all health measures. The Minister and his public health

official have the unwelcome task of dividing items of proposed expenditure into two groups: (*a*) those which at that time have no hope of being accepted; and (*b*) those which make some public appeal and have, therefore, some political value.

While this statement is generally true, its acceptance as an absolute statement of the position would be unjust to ministers and governments; but it does illustrate how they are limited in activity by public opinion, and it does add point to the following passage in Syme's presidential address:

> It ought to be the business of health authorities to make governments and people appreciate that health and safety cannot be secured without heavy expenditure. They must also be taught that money so expended will be well spent and truly reproductive, by promoting efficiency and reducing economic loss.

From my long experience I say that statement throws too heavy a portion of the responsibility onto the public health official. If the people would unanimously resolve that they would pay in taxes whatever is necessary for all measures required for the "culture of human life" as well as, or instead of, all the expenditure involved in satisfying their personal and sectional interests, then most of the difficulties would vanish. But there is one sad lesson the public health official soon learns, which is that throughout the whole community self-interest is as inevitable as original sin.

Public opinion is of the first importance in support of, or in opposition to, the work of the public health official. Neither the Minister nor the official needs ever to ask himself in self-examination: "Did I do right? Could I have done more?" The public, the profession and the Press answer the unspoken thought.

Let me quote again from Syme's presidential address:

> It is not the medical profession that is chiefly to blame because disease is not prevented. It is the public, individually and collectively, that is mostly at fault. Members of the profession are ceaselessly striving to educate the public as to the supreme importance of health and as to the proper measures necessary for maintaining good and avoiding ill health. The members of the public cannot be persuaded for their own good to adopt these measures, even when most obvious.

While this is partly true, I do not accept it as a completely accurate statement of the reaction of the public. I believe that slowly through years the public listens, learns and adapts its habits to the newer knowledge. If it were not so, all our work would be without hope.

As to the profession, this is what Sir George Syme said:

> It is true that the ordinary general practitioner in the past has been more directly concerned with the treatment of actual disease than with its prevention, but that is because disease has always been present and required treatment, and curative work has necessarily taken up the largest proportion of the time and energy of the ordinary practitioner . . . It is, however, true that in the past general practitioners might have had more training in the preventive aspects of medicine, might have cooperated more satisfactorily with the public health officials and might have adopted a more sympathetic attitude to their work.

If I refrain from comment on that quotation, it is because I would rather look hopefully towards the future than sadly into the past.

We, who have had official responsibility for the care of public health, owe much to the newspapers of Australia, as they have, either at our request or on their own initiative, kept continually before the public all knowledge of progress in medicine and of measures for the promotion of individual or public health.

There is, however, a definite lack of balance in the emphasis given to different sections of the subject, with undue stress on the sensational. Considerations of space, of time and of newspaper rivalry are such that it is rarely possible to secure a balanced presentation of any topic and it is

noticeable that such topics as venereal disease or artificial insemination always have an assured priority in certain newspaper offices; doubtless because of the irresistible appeal pelvic functions have always had.

Parliament, the medical profession and the people are inseparable partners in this search for a better life for mankind, and our profession has, as Sir George Syme said, a special responsibility.

The public health official has a special share in the responsibility in that he, more than other members of our profession, has to deal with social problems in their larger aspect. The practising members of the profession have to face difficult aspects of social problems as they affect the individual, but the practising doctor is helpless without the efforts of organized society.

For the full interpretation of the culture of human life, the parliament, the public health official and the practising doctor must all work together.

But we are now facing seriously all the practical implications of that admitted necessity. The work of the medical profession is being, like everything else, increasingly mechanized. Transport by land and air, hospitals with coordination of hospital services, the necessity for securing every individual in the community against physical and economic adversity—all these have meant that the doctor has become much less of an isolated, self-reliant individual and much more a unit of a system than he was in the quite recent past.

Whatever opinions different people may hold, there can be no doubt that there is an irresistible surge of belief that what we are now speaking of as the culture of human life involves and implies in some form or other what has come to be known in general terms as "social security".

The evolution of this social impulse will undoubtedly mean considerable modification of present relationships between organized medicine and society. The four freedoms which we all recognize as high—and possible—ideals must be bought at a price. Part of that price is freedom itself, for the individual cannot secure for himself freedom from fear or want; he is here almost entirely dependent upon the general social organization.

It cannot be said that we have yet found the answer to the many doubts and questions raised by the prospect of this evolution.

Nearly a century ago, Mill, in his famous essay on liberty, stated the problem:

> The subject of this Essay is not the so-called Liberty of the Will, but Civil or Social Liberty: the nature and limits of the power which can be legitimately exercised by society over the individual.
>
> What then is the rightful limit to the sovereignty of the individual over himself? Where does the authority of society begin? How much of human life should be assigned to individuality and how much to society?

Mill did not, even after much argument, do more than state various established positions on this problem. We know the answer must be found; but we have not yet, for all our thought and talk, taken more than the first step.

I ask you to note that I have deliberately selected quotations centuries old. You will appreciate the significance of that selection as indicating that, notwithstanding social evolution or the advancement of learning, human reactions have changed very little.

Sir George Syme appreciated even twenty years ago the difficulty of reconciling social organization with the preservation of individual liberty when he, as chairman, wrote the concluding passage to the report of the Royal Commission on Health. He said:

> The present position is one in which the immemorial contest is going on between State control and voluntary effort. If every human being aimed at the ideal there would be no need for control. If everyone was controlled, the human being would

become a machine and progress would stop. The successful result of any scheme that may be devised will depend not so much on its adoption by the Commonwealth as on the degree to which States and individuals who constitute the Commonwealth cooperate in an endeavour to carry it out.

Parliament, our profession and the people must make a combined effort, advancing step by step, even generation by generation, towards that fuller culture of human life which we all desire to see realized.

The people and parliament must look to our profession for much of the guidance necessary, for it is our profession only which has much of the necessary knowledge.

So, and this is what I have been trying to say in this oration, all branches of our profession should work in unity and harmony, facing the tremendous challenge this last war has brought to society in this and other countries.

The Royal colleges might well consider whether they can even more profitably than at present extend the range of their activities in social medicine.

Your college might recognize, with something more practical than the consent of reason, that the culture of human life involves more than the study of the processes of death, more than mutilations which, however necessary and merciful, inevitably scar both body and mind.

The sister college—of the physicians—might concede in deeds as well as in intellectual appreciation that the culture of human life requires the study of man as a machine, as a mind and as a member of a community.

The search for new knowledge—research—should not be allowed, as some would have it, to stand apart in a mystic, monastic detachment without any organic or constant association with those who are dealing with the great and urgent problems of medical science in its relation to social conditions.

The general profession might well free itself from any justification for the reproach of lack of sympathy with the work of those who have the great responsibility of advising governments. The public health officials should, as I know they wish to do, extend and enlarge the intimacies of their contact with the practising profession. Already a good foundation has been laid in an existing council for this cooperation between all branches of the profession, and upon it an enduring structure can be built.

I have tried in my own words and thoughts to carry through the ideals expressed by Sir George Syme in his presidential address and given practical form by him in the Royal commission report.

We are facing today the possibility of social chaos beyond anything he could have imagined when he wrote "never was a time in history when the culture of human life was more necessary or more important than now".

Mr. Hughes, then Minister for Health, in his inspiring address at the inaugural meeting of the National Health and Medical Research Council, said:

> By health I do not mean a negative condition—mere freedom from active disease—but that state of abounding energy and vitality that makes one rejoice and glad to be alive.

That is the expression of the physical side of the culture of human life; but at this stage I would like to refer to a strikingly suggestive address by Harold Ritchie (Anne MacKenzie Oration, 1940).

After pointing out that organic and structural disease of the body may arise from psychical causes, that an important effect of emotional provocation of the autonomic mechanism is the stimulation of the glands of internal secretion, and that if emotion is "bottled up" it may reproduce itself later in the form of some more or less ill-defined symptoms of disordered bodily function, he concludes that "the prevention or cure of the manifold disorders

we have been considering comes from within as well as from without. Prevention demands an increasing knowledge of self, increasing self-control."

But surely there is another happier method of prevention. Why should the emphasis be only on self-control? Fear and discouragement depress the activity of our internal secretions, with lowered general health: hope, pride and encouragement stimulate them to activity, with increased health, vitality and mental activity.

I suggest that two things are vitally necessary to the culture of the fullest human life—a clear concept of ultimate purpose, and pride in that purpose and in the work necessary to it. Purpose and pride are surely the two most potent factors in polarizing the cerebral cortex and stimulating the internal secretions, bringing increased vitality and physical health.

There is the great social problem all over the world today—how to preserve freedom for individual purpose, and pride in individual achievement, in the presence of that close organization of society which is coming with irresistible momentum.

I believe, as Ritchie said, that "national characteristics will tell in the future as they have in the past", and I believe that this country of ours will find the right answer before any other country.

Our profession could have immense influence in the solution of this problem, if it would combine all its now scattered resources in a spirit of greater service to mankind—even beyond the limits of purely medical interests.

Of the various reforms now under attention I, being no longer an active unit, will say only this, that if we do not move forward towards some practical approach to known social problems, then we will face new difficulties mounting with each new phase of reconfirmed inertia. Mistakes will surely be made—but so will progress.

In doing honour to George Adlington Syme, I have dwelt on that ideal for our profession which he took for the theme of his presidential address. I can say with knowledge that his mind was, throughout that first hour's talk and in all later discussions, straining through details to the expression of the ideal of fuller service by the profession to the people.

We of our profession can feel that no greater privilege could be offered to any man than to have assigned to him that special function which was in fact the declared mission of the divine Founder of our faith: "I am come that they might have life and that they might have it more abundantly."

SURGICAL HAZARDS IN THE TREATMENT OF CHOLECYSTITIS AND CHOLELITHIASIS.[1]

By J. B. G. Muir,
Hobart.

Since Langebuch performed the first successful cholecystectomy in 1882 and Courvoisier the first successful supraduodenal choledochostomy in 1884, surgery of the biliary tract has advanced a long way. Today, for example, cholecystectomy is regarded as a comparatively safe operation when undertaken in the absence of complications. As with all major surgical procedures, however, there remains a certain operative mortality which, according to published results, varies considerably in different clinics throughout the world. These variations appear to depend partly on operative technique, although this has now become practically standardized, but more particularly on the surgeon's judgement of the time and type of operation, which should be performed *vis-à-vis* the presence or absence of inflammation. Certain well-recognized and commonly recurring causes of death beset the surgery of the biliary tract, and it is only by seeking to avoid them that surgical risks can be reduced. During the last decade many papers dealing with these risks and complications have been published, and in this paper, the object of which has been to collect and analyse the results of such operations performed in the Royal Hobart Hospital by members of the surgical staff, surgical hazards and results experienced locally will be reviewed in the light of published statistics and experience.

The period covered by this review dates from July 1, 1936, to June 30, 1945, and the results are arranged in the following tables.

Table I.

Observation.	Total.	Males.	Females.
Patients with cholecystitis and cholelithiasis submitted to operation[1] ..	421	71	350[2]
Total deaths in hospital following operation..	32	8	24
Operative mortality rate..	7·6%	11·9%	6·8%

[1] Average age, 51 years: extremes, 26 and 83 years.
[2] Proportion of females to males, 5 to 1.

All non-acute cases included were confirmed radiologically by Graham's test, as cholecystitis and cholelithiasis before operation.

Table II.
Pathological Classification.

Condition.	Totals.	Deaths.	Percentage.
Chronic cholecystitis—			
No calculi	8	Nil	2·15
With calculi	270	6	
Acute cholecystitis—			
No calculi	3	Nil	18·4
With calculi	100	19	
Cholecystitis complicated by common duct stones with or without jaundice	34	7	20·5
Common bile duct stones recurring after or overlooked at previous cholecystectomy	3	Nil	
Stricture of common bile duct following previous operation trauma ..	2	Nil	
Intestinal obstruction due to gall-stone impaction	1	Nil	

[1] Accepted for publication on January 10, 1946.

TABLE III.

Surgical Classification.

Pathological Condition.	Operation Performed.	Total.	Deaths.	Percentage.
Chronic cholecystitis and cholelithiasis.	Cholecystectomy.	278	6	2·18 } 5·6
Acute cholecystitis and complications including gangrene perforation and empyema.	Cholecystectomy.	63	13	20·6 } 18·4
	Cholecystostomy.	40	6	15·0
Cholecystitis complicated by common duct stones with or without jaundice.	Cholecystectomy, exploration of common bile duct, and choledochostomy.	34	7	20·5
Common bile duct stones recurring after or overlooked at previous cholecystectomy.	Choledochotomy and choledochostomy.	3	Nil	
Stricture of common bile duct following previous operation trauma.	Excision of stricture and plastic repair.	2	Nil	
Intestinal obstruction due to impacted gall-stone.	Enterotomy and removal of stone.	1	Nil	

In addition to the presence of gall-stones, the pathological conditions set out in Table IV were recorded as operation findings.

TABLE IV.

Pathological Condition.	Observations.
Adhesions	These occurred in varying degree in most cases between the gall-bladder and duodenum, stomach, transverse colon and abdominal wall.
Fistulæ	Four cases of fistulæ between the gall-bladder and duodenum were found at operation. All patients had long histories, and the fistulæ were found at operation during acute attacks.
Strawberry gall-bladder ..	This condition of cholesterosis of the gall-bladder mucous membrane was recorded in 11 cases.
Hydrops of the gall-bladder ..	Greatly distended gall-bladders containing clear sterile fluid, with blocked cystic ducts, or stones impacted in Hartmann's pouch were noted in six cases.
Acute pancreatitis	An early stage of acute pancreatitis with fat necrosis was found in one acute case only which recovered with drainage.
Intestinal obstruction	Due to an impacted gall-stone in the lower ileum. One case of this now rare complication of gall-stones was found. The stone having ulcerated through from the gall-bladder to the duodenum, was removed by simple enterotomy with relief in a woman aged sixty-three years.

GENERAL COMMENTARY.

Any standardized surgical procedure for the relief of a particular disease has become so by the guidance of published experiences, and it is only by accepting such guidance that the risks of an operation can be reduced to the minimum. It is always salutary for us to consider our own statistics from time to time in comparison with those of other clinics, particularly in so far as mortality rates are concerned, for it is only by analysing its causes and seeking to avoid them that mortality can be reduced. I propose therefore to discuss these results from two aspects: (i) the pathological condition present and the type of operation performed, (ii) the actual causes of death occurring in each group.

CHRONIC UNCOMPLICATED CHOLECYSTITIS AND CHOLELITHIASIS.

Examination of these figures shows that excluding cases in which exploration of the common bile duct was necessary, 278 operations were performed in the absence of acute inflammation, with six deaths—a mortality of 2·15% (275 cholecystectomies, six deaths; three cholecystostomies, no deaths). Of these six post-operative fatalities, one was due to pulmonary embolus, three to the so-called "hepato-renal" syndrome during the first week, and two to internal hæmorrhage.

ACUTE CHOLECYSTITIS.

When surgical treatment was carried out in the presence of acute inflammatory changes in the gall-bladder, the mortality rose to 18·4%. This mortality rate for operation in the acute phase is much too high, and one has to determine if it is avoidable, either by altering the surgical methods used or by refraining from surgery during the acute phase unless urgent complications render this a life-saving measure. It is of course necessary to define clearly the type of condition which may be classified as acute cholecystitis. In this series, in order to differentiate between simple biliary colic and acute cholecystitis, in addition to consideration of the case histories in relation to previous attacks, the presence of certain definite clinical findings was considered necessary. Cases were classified as "acute" on the following clinical signs: rise in temperature, the average being between 99° and 100° F.; rise in pulse rate, the average being 100 to 110 per minute; pain and local hyperæsthesia over the gall-bladder and/or the presence of a tender and enlarged gall-bladder on palpation. In all, 103 cases were recorded in this group, and the pathological findings at operation were reported as shown in Table V.

TABLE V.

Pathological Findings at Operation.	Total.	Number of Deaths.
Acute cholecystitis, in varying degree	22	1
Acute cholecystitis with commencing gangrene	13	3
Acute cholecystitis with perforation and peritonitis	5	3
Acute cholecystitis with cholecysto-duodenal fistulæ	4	1
Acute cholecystitis with accompanying pancreatitis	1	—
Acute cholecystitis communicating with liver hydatid	1	1
Acute cholecystitis, empyema of the gall-bladder	57	10

Cholecystectomy performed in acute cholecystitis (63 cases with 13 deaths) carried with it a mortality of 20·6%, whereas the mortality for cholecystostomy was 15%, despite the fact that it was selected for the poor risk cases.

It is interesting at this stage to compare our mortality figures with those in other clinics (see Table VI).

TABLE VI.

Clinic.	Chronic Cholecystitis.	Acute Cholecystitis.	All Cases Mortality.
Wakeley	5·5%	23·1%	7·3%
Heyd	3·3%	—	7·0%
Love	—	21·0%	—
Pennoyer	2·5%	25·0%	—
Mayo Clinic	1·66%	5·0%	2·71%
Glenn	—	1·9%	3·3%
Ehnmark	1·8%	10·5%	7·4%
Royal Hobart Hospital	2·15%	18·4%	7·6%

Immediate Operation or Conservative Treatment in Acute Cholecystitis.

The question whether cholecystitis in the acute stage should be treated conservatively, or whether the patient should be subjected to immediate operation is one which has of late years been the subject of considerable controversy in medical literature, and many statistics have been quoted in support of either opinion. For example, Pennoyer, Wakeley and Rutherford Darling have all advocated the conservative policy of allowing acute chole-

cystitis to subside under expectant treatment in hospital, with operation some three to four weeks later, whilst Glenn, Heuer, Heyd and Lahey advocate immediate surgery in this condition, preferably during the first twenty-four hours of the attack. Glenn quotes the remarkably low mortality figures of 1·9%; Darling considers that only some 5% to 7% of patients do not respond to conservative treatment and require operation on clinical indications of progressive inflammation; whereas Heyd quotes 20% as the proportions which progress to gangrene and perforation, this representing from 10% to 20% of the total mortality in the general run of gall-bladder cases.

The fact is, of course, that generalization is impossible in this condition and that each case of acute cholecystitis should be treated on its merits, the patient being under observation in hospital. Consideration of the local pathological process should always be in our minds. We know that apart from a small proportion of welchii infections (Whitby and Gordon-Taylor) the organisms causing cholecystitis are usually *Bacillus coli* and streptococci of low virulence. In the early stages the inflammatory process is catarrhal in type, and limited to the mucous membrane and submucous tissue. Provided there is no obstruction, the tendency in first attacks is to subside, leaving local adhesions on the peritoneal surface of the organ and a thicker gall-bladder wall. That many attacks of this nature do occur before one of greater severity causes the patient to seek hospital treatment is frequently suggested by the history. If interference to the local circulation or obstruction to the outflow of the gall-bladder contents occurs, however, the condition becomes much more serious and the tendency to subside diminishes. In this there is a direct analogy with the obstructive form of appendicitis described by Wilkie as being the most serious form and that most likely to cause general peritonitis. Obstruction in acute cholecystitis may result from simple inflammatory congestion of the valvular-like mucous membrane lining the cystic duct or from impaction of a stone in the duct or in Hartmann's pouch. In such cases the gall-bladder becomes tensely distended and congested, so that, as seen on laparotomy, it is a dark crimson colour with the wall thickened and œdematous, and the viscus has the appearance of being embedded in the liver. Internally, the mucous membrane becomes swollen and ulcerated and the lumen filled with purulent bile or actual pus, causing the condition described as empyema of the gall-bladder. Denton has advanced the theory that in a number of cases of acute cholecystitis mechanical and circulatory effects rather than bacterial infection are responsible for the principal pathological changes. He points out that the veins draining the gall-bladder are much more closely incorporated with the cystic duct than is the cystic artery, so that pressure of a stone in the duct may close the veins before the artery and so lead to œdema, congestion and infarction.

Saint has emphasized the necessity for immediate operation on the tender, palpable gall-bladder, pointing out that the tension in the gall-bladder may become so great that the blood supply is compressed, with resulting gangrene. Should an area of gangrene result, early perforation is likely, and Touraff, in a survey of cases at the Mount Sinai Hospital, New York, has pointed out that there is seldom any clinical indication during an attack of acute cholecystitis that pus is present—that is, that the case has progressed to empyema or actual gangrene. Perforation in a "watched" case is frequently the first indication that the attack is not subsiding. Mentzer recorded four instances in which perforation of the gall-bladder occurred whilst the patients were under observation in hospital, and the condition was not recognized before death in any of the cases. In this series there were five cases of perforation, three of which took place in hospital without warning in acutely ill patients under observation. The catastrophe is said to occur more com-

monly in elderly patients suffering from acute cholecystitis, particularly in males, and it is interesting to note that two of the patients in question were old gentlemen of sixty-eight and seventy-one. These complications of non-resolving acute cholecystitis are, of course, arguments in favour of early surgical intervention, but preferably in early stages of the disease rather than routinely during any of the acute attacks. There is little doubt that in a younger type of patient, whose liver function has not been impaired by numerous attacks of cholangitis, cholecystectomy performed in the early catarrhal stage, when the normal surgical anatomy is not badly obscured by inflammatory exudate—that is, during the first forty-eight hours—is not a very formidable technical undertaking, and the risk is not great. It must be remembered, however, that these patients are not always seen at that stage, and have usually been sick at home for several days before admission to hospital, so that the day of admission is by no means the first day of the attack. A careful history and assessment of the local pathological process as a guide to the time of operation are therefore most necessary. If the patient is not seen until the fifth or sixth day, the gall-bladder will be surrounded by adhesions and considerable local sero-fibrinous exudate will be present. There will be difficulty in securing the proper plane of separation of the gall-bladder from the liver, and also, owing to troublesome oozing and friability of tissue, in subsequently peritonealizing the gall-bladder fossa when the organ has been removed. In such cases the hepato-duodenal ligament is always swollen and œdematous, and the veins between its folds are engorged and bleed readily, quite unlike minor vessels encountered there in cases of chronic cholecystitis. The cystic lymph glands will also be enlarged and inflamed. These facts will make the clear dissection of the cystic duct a difficult matter, and failure to secure the cystic artery and the perpetual bugbear of damage to the common bile duct become real dangers. In such cases these dangers can be avoided by performing cholecystostomy if necessary under local anæsthesia, should immediate surgery be warranted by the progress of the case. Careful analysis of the records of acute cases in this series shows that in about one-half operation was carried out within twenty-four or forty-eight hours of the patient's admission to hospital, when it appeared from pulse and temperature improvement that the process might have subsided with expectant treatment, permitting subsequent surgery during a quiescent period. In the majority of these cases, however, the factors determining intervention appeared to be severe, and persisting local pain, persistent vomiting, and a tender, palpable gall-bladder, and operation usually revealed what was recorded as actual empyema of the gall-bladder. This was found in about 50% of the acute cases in which operation was performed. The contents of such tensely distended gall-bladders vary from clear mucus to actual pus, depending upon the degree and virulence of bacterial infection. In the majority of cases the tendency is for the acute phase to subside, and it is only in the small percentage quoted that perforation will occur. When from the clinical signs operation is imperative, safe surgery is obviously indicated, and in this series had cholecystostomy been performed only as a temporary life-saving measure, instead of cholecystectomy, five deaths from reactionary hæmorrhage and two from biliary peritonitis would presumably not have occurred, reducing the mortality figures to 11·6%.

It will be noted that of the 19 deaths following surgery in the acute phase, ten occurred in cases of empyema of the gall-bladder, three in cases of gangrene of the gall-bladder, and three in cases in which perforation of the organ had actually taken place.

In discussing the time at which to operate in an attack of acute cholecystitis, Devine points out that "if a patient who is in reasonably good

condition has a severe attack of cholecystitis, has not had many previous attacks and therefore has a free-lying gall-bladder, prompt operation is the soundest procedure, and that in such an operation the 'safety first' desideratum hinges mainly round the skill of the cholecystectomist".

As I have mentioned previously, sponsors of immediate surgery in acute cholecystitis point out that there is no sure guarantee that complications will not occur while a waiting policy is being pursued, but it is very suggestive that during the whole period under review (nine years) there were 243 admissions on the medical side of the hospital for cholecystitis and investigation of suspected cholelithiasis, actually confirmed by cholecystography. Of the 243 patients, 54 were admitted with a diagnosis of acute cholecystitis on the clinical symptoms previously mentioned, and all except three recovered satisfactorily from the attack, rather confirming Darling's estimate that only 5% to 7% of acute cases progress to a stage requiring urgent operation. As in other diseases, economic factors seem to influence the prognosis, and the mortality rate among hospital patients appears to be higher than among those seen in private practice. (Heyd—private patients, 4·8%; hospital patients, 13·5%.)

In many of the hospital cases reviewed the patients gave histories of attacks of pain and colic for many years. Thirteen had had cholecystostomy performed at periods varying from three years and over before finally undergoing cholecystectomy. In a busy hospital out-patient department today one so often finds that patients suffering from cholelithiases and advised to come in for operation postpone the day indefinitely because of inability to obtain domestic help to run the home or look after the children. This procrastination proceeds — sometimes with the pharmacist's assistance — until eventually another and possibly complicated acute attack occurs, and the patient comes in as an emergency on a stretcher. In an Hunterian lecture Love pointed out that one of the evils of expectant treatment during an attack of acute cholecystitis was the fact that patients simply did not return to have cholecystectomy performed later during a quiescent period, but only during further acute attacks which became more and more fraught with danger.

The longer the history of the disease and the older the patient, the greater the risk of complications and the operative mortality. If we consider the problem, therefore, in the light of local and published experiences, it would appear to be obligatory in every case to watch the patient who is in hospital during an attack with facility for immediate operation should the condition progress to complications. Then if intervention is necessary and the local anatomy difficult, cholecystostomy will give the lesser mortality and can be followed later on by cholecystectomy. All patients safely over an acute attack should be operated upon at the first opportunity when quiescence has taken place, usually in three or four weeks' time, when the gall-bladder can be removed with little risk.

CHOLECYSTITIS COMPLICATED BY STONES IN THE COMMON BILE DUCT.

In this series exploration of the common bile duct for the removal of stones was combined with cholecystectomy and cholecystostomy in 34 cases with seven deaths—a mortality rate of 21%—a very serious rise as compared with 2·15% in uncomplicated cholecystectomy. It is a well-known fact that when it is necessary to explore the common duct during operations on the biliary tract, the operative risks are materially increased, chiefly because in most cases the necessity for this step is the presence of jaundice or cholangitis, often of long-standing duration. These risks are emphasized in the causes of death reported in this category. All occurred in jaundiced patients with long histories and were due to: biliary peritonitis, three cases; liver failure,

two cases; internal hæmorrhage, one case; and pulmonary embolus, one case. These causes of death are commented upon later.

The increased risk attending exploration of the common duct appear to vary considerably according to the published figures, set out in Table VII.

TABLE VII.

Clinic.	Chronic Cholecystitis.	Common Duct Stones.
Mayo Clinic	1·66%	6·93%
Brooks and Wyatt	2·6%	20·0%
Santee	6·3% (and acute)	30·0%
Glenn	1·9% (and acute)	12·5%

Lahey's findings of stones in the common duct in approximately 20% of all cases of cholelithiasis in which operation was performed at his clinic has prompted surgeons to explore the common duct more frequently, particularly as in 39% of the cases in which common or hepatic duct stones were found and removed, jaundice had never been present. In view of the increased mortality rate attending this procedure, however, it should be undertaken only in the presence of certain definite indications. Naturally the discovery of a palpable stone in the duct in the course of cholecystectomy would render it obligatory. Hurley recently summed up the indications for duct exploration for suspected stones, where they cannot be palpated from outside, as follows: (i) There is a history of recurrent attacks of jaundice with intermittent colicky pain, and in about one-third of cases attacks of fever with rigors. (ii) The duct is enlarged, thick-walled and opaque. (iii) The head of the pancreas is harder than normal. (iv) Aspiration by means of a fine needle may show that the bile is turbid or there may be white bile. (v) The gall-bladder may be small, contracted and thick-walled. (vi) The liver may be enlarged and congested.

As will be stressed later, careful drainage must be provided for in these cases, not only of the bile duct, to relieve biliary obstruction, but also to provide for the free escape of any intraperitoneal leakage of bile. The period of drainage of the common duct after removal of stones must be decided upon on the merits of each case. The normal secretion of bile by the healthy liver is from 25 to 30 ounces in twenty-four hours, and if the duct drainage tube is carefully connected to a collection bottle and the bile drainage measured, a good estimate of the amount passing through the duct to the intestine can be obtained. Obviously if the stools are a normal colour and not clay-coloured, there can be little or no obstruction of the duct. In any doubtful case it is always well to perform cholangiography before removing the duct drain. If there is any suspicion of a stone still being present, Pribram's method of ether instillation as a stone solvent should be tried. The tube should be clamped off for increasing periods daily prior to its removal.

In recent years prolonged drainage of the common duct has been advocated by American surgeons in cases in which any marked biliary obstruction with accompanying liver inefficiency has been present, drainage being maintained until the percentage of the bile salts in the escaping bile is normal. This measure has also been carried out with success in so-called cases of "biliary dyskinesia" or colic following cholecystectomy where no residual stone is present and the symptoms seem to arise from some spasm or dysfunction of the sphincter of Oddi. In such cases, where there is naturally a well-shut-off drainage track, the risk of biliary peritonitis does not arise.

OPERATIONS ON THE COMMON BILE DUCT AFTER CHOLECYSTECTOMY FOR STONES OR STRICTURE.

Stones.

Stones in the common duct overlooked at cholecystectomy have been shown by Lahey to be more common than thought, and are probably responsible for some of the discomfort ascribed to adhesions following the operation.

In this series three patients were operated upon for stones overlooked in the common bile duct at a previous cholecystectomy. In each case the second operation was performed within two years of the previous operation. In one case the stone was impacted in the sphincter of Oddi, and was removed by a transduodenal approach; in the other two cases it was removed through the supraduodenal portion of the duct. All three patients had suffered from repeated attacks of intermittent jaundice and pain, with occasional attacks of fever since cholecystectomy, and all made a good recovery.

Common Duct Stricture.

Injury to the common bile duct has long been regarded as one of the commoner pitfalls of cholecystectomy, and this risk has always been emphasized in surgical teaching. This emphasis would appear to have borne fruit; at any rate in the series under review no cases occurred. Two patients with common duct stricture were admitted for treatment following cholecystectomy performed in small country hospitals for acute cholecystitis nine months and one year previously. In each case the symptoms were similar—chronic biliary fistulæ with wasting. From time to time the fistulæ would heal, and the patients become jaundiced and suffer pains resembling biliary colic. Reopening of the fistulæ would bring relief of both pain and jaundice. In each case biliary obstruction had been caused by stricture following clamping of the cystic duct at its junction with the common duct. Tight strictures had formed with fistulæ from the dilated proximal portion of the duct. In each case the stricture was excised and the duct reestablished around Kehr's "T" tubes. In the case of one patient who had already submitted to two operations to relieve the stricture, temporary success for six months was obtained, but the old symptoms returned and death took place from liver failure one year later. The second patient is still well and comfortable, but from time to time suffers from attacks resembling mild biliary colic, two years afterwards.

In commenting upon these mishaps one can only say that even if urgency prohibited the patient's transfer to major hospitals, cholecystostomy for the original acute symptoms would have avoided the trouble.

CAUSES OF DEATH OF 32 PATIENTS FOLLOWING OPERATIONS FOR CHOLECYSTITIS AND CHOLELITHIASIS.

If the deaths in this case series are considered first in regard to the pathological condition obtaining at the time of operation and then in regard to the actual cause of death, we obtain a picture of the risks attending surgery in the chronic or quiescent, acute and complicated phases of this condition, and also of the commoner causes of death in gall-bladder surgery (Table VIII).

Age at Death.

Of the 32 patients who died, four were under forty, five were between forty and fifty, and 23 were over fifty years of age, showing that the mortality rate rises with increasing age.

At the risk of being considered wise after the event, I propose to comment on those causes of death directly attributable to the anæsthetic or operation, with reference to the type of case in which their occurrence is likely, and to measures which may be taken to avoid them.

TABLE VIII.

Causes of Death in Order of Frequency.	Operation During		Operations for Common Bile Duct Obstruction.	Total.
	(*a*) Quiet Period.	(*b*) Acute Period.		
Pulmonary complications—				
Embolus	1 (f.)	1 (f.)	1 (f.)	3
Pneumonia[1]	Nil	2 (f.) 3 (m.)		5
Internal hæmorrhage—				
Secondary	Nil	1 (f.) 1 (m.)		2
Reactionary[2]	2 (f.)	1 (f.) 2 (m.)	1 (f.)	6
Liver failure, hepato-renal syndrome, uræmia	3 (f.)	2 (f.)	2 (f.)	7
Biliary peritonitis	Nil	1 (f.) 1 (m.)	3 (f.)	5
Congestive heart failure		2 (f.)		2
Hæmatemesis		1 (m.)		1
Hyperpyrexia		1 (f.)		1
All deaths	6 (f.)	11 (f.) 8 (m.)	7 (f.)	32

[1] Included three cases of wound dehiscence after coughing, requiring a second anæsthetic for resuture.
[2] Hæmorrhage causing death within forty-eight to seventy-two hours after operation.

Pulmonary Complications.

As will be noted from Table VIII, death was caused by pulmonary complications in eight cases. These were as follows:

(*a*) Pulmonary emboli: Three cases occurring on the eleventh, twelfth and nineteenth days following cholecystectomy.

(*b*) Pneumonia with heart failure: Five cases. These were all of the bronchopneumonic type, and included three cases in which wound dehiscence occurred after coughing on the ninth, tenth and eleventh days after operation, necessitating another anæsthetic for resuture.

In so far as the cases of pulmonary embolism are concerned, the complication is one which may occur after any major abdominal operation and must always be regarded as an imponderable risk in the late middle-aged, obese, gall-bladder patient.

The deaths from pneumonia all occurred in cases of acute cholecystitis or common duct stone, the average age of the patients being sixty-seven. Had penicillin therapy been available during the greater part of the period under review, these deaths might not have occurred. It is perhaps true to say that there is no branch of surgery in which the anæsthetic has to be so carefully chosen to meet the patient's requirements and so carefully administered as in gall-bladder surgery. Most surgeons have had some experience of attempting cholcystectomy in an obese, cyanosed and resistant patient, when abdominal relaxation is poor. At the Mayo Clinic it has been found that pulmonary complications are three times more frequent than any other post-operative complication after surgery on the biliary tract, and the importance of avoiding operation when the patient has the slightest cold or sore throat is stressed. Many surgeons today advocate the use of spinal anæsthesia in gall-bladder surgery, chiefly because of the abdominal muscular relaxation

obtained. Considerable experience in its use at that level is necessary, however, and there is no evidence that it actually reduces the number of chest complications. My own experience has been that some supplementary anæsthesia is usually necessary during part of the operation. Carefully administered gas-oxygen/ether or ether by the Nuffield inhaler or on the open mask appears to suit the majority of patients. One point of great importance is the free administration of oxygen throughout the operation, whatever method of anæsthesia is used, not only to avoid cyanosis and respiratory effort embarrassing to the surgeon, but also to avoid any damage by the anæsthetic agent to liver function. Free administration of oxygen and "Carbogen" during the twenty-four hours following operation will greatly diminish the risk of pneumonia or lung collapse in these cases and should be routinely employed.

Hæmorrhage.

In this series there were eight deaths from hæmorrhage, occurring from the operation area. In two cases the hæmorrhage was definitely secondary in type, taking place on the tenth and fourteenth post-operation days respectively. In both cases hæmorrhage followed cholecystectomy for acute cholecystitis in which the persistence of free bile drainage from a poorly tied cystic duct had necessitated the retention of a drainage tube. The hæmorrhage appeared to come from a cystic artery tied very close to its origin from the right hepatic artery in each instance. Transfusions and urgent laparotomy failed to save either patient.

In another case a badly jaundiced patient died owing to a general oozing from the gall-bladder fossa two days following cholecystectomy and choledochostomy for stones in the common bile duct. In the remaining five cases internal hæmorrhage followed the removal of gauze strip drains forty-eight hours after operation. The gauze strips had been packed into the gall-bladder fossa in each case to control troublesome oozing after cholecystectomy, and their removal probably disturbed the cystic artery ligature. Their use is obviously to be discouraged, except in the form of "cigarette" drains surrounded by rubber tissue, and the fatal results in these cases must be regarded as due to faults in technique.

Hæmorrhage during or immediately following cholecystectomy is much more liable to occur in acute cases, by division of an anomalous vessel where inflammatory exudates render identification difficult, from a friable cystic artery which tears away in the forceps whilst being ligated, or where the ligature cuts through. The tendency for the bleeding vessel to retract up behind the common duct, where attempts to clamp it in a blood-swamped field may result in injury to the hepatic artery, portal vein or common duct, is well known.

Payne, in discussing the post-operative care of gall-bladder operations, has advocated the routine use of continuous gastric suction until all tendency to vomit has passed. He considered that the strain of vomiting was a common cause of hæmorrhage from the cystic vessels. In so far as general bleeding from the operation area in jaundiced cases is concerned, Heyd points out that the standard pre-operative treatment by intravenous administration of glucose, calcium, vitamin *K et cetera* is by no means as effective as imagined. He found that in some 40% of cases in which death followed operations on the common bile duct for obstructive jaundice a large quantity of blood was found in the peritoneal cavity, and that this actually occurred in patients rendered relatively safe surgically before operation by obtaining normal bleeding and coagulation times. He emphasizes the great value of repeated pre-operative and post-operative blood transfusions, which all surgeons who have had to cope with many common duct obstruction cases will endorse.

Biliary Peritonitis.

By the term biliary peritonitis is meant the intraperitoneal extravasation of bile, which in the vast majority of cases occurs as the result of injury to the biliary tract. This may occur from perforation of a gangrenous area in the wall of an acutely inflamed gall-bladder, caused by local pressure of an impacted stone. Unfortunately, however, it occurs more commonly as a post-operative complication.

Devine has emphasized the fact that a very considerable quantity of bile can collect in the peritoneum from duct leakage after cholecystectomy, with very few symptoms, and Illingworth and Dick point out that whereas a sterile effusion of bile in man leads to remarkably little disturbance, biliary extravasation in cases of cholecystitis where the fluid is highly infectious leads to diffuse peritonitis, which in nearly 50% of cases is fatal. Wangensteen considers that even the leakage of sterile bile into the peritoneum is very dangerous, because if a considerable amount collects, death follows from cholæmia due to the toxic action of bile salts.

In this series of cases under review five deaths from biliary peritonitis took place and the patients included one male and four females. In two cases in which cholecystectomy had been performed for acute cholecystitis, symptoms of peritonitis necessitated reopening the abdomen, in one case eight and in the other twenty-five days after operation. Drains in each instance had been removed forty-eight hours after the original cholecystectomy and at the second operation large collections of bile were found in each case. In the other three fatal cases jaundice was present, and exploration and drainage of the common duct were performed. In one case kinking of the common duct "T" tube brought out through a stab wound in the flank had caused bile leakage internally, and in the other two cases bile had leaked around the common duct drain, causing large intraperitoneal collections. Despite recognition of the condition in all three cases, and secondary drainage, death occurred.

The quantity of intraperitoneal fluid in these cases can be very great, much more so than the actual quantity of bile which has leaked, and consists partly of inflammatory exudate caused by bile irritation of the peritoneum.

In cases following operation the source of the bile is usually: (*a*) from the presence of aberrant bile ducts in the gall-bladder fossa exposed after excision of the vesicle (Flint); (*b*) slipping of the ligature on the cystic duct, which, owing to its mucous lining, has none of the self-sealing qualities of a vessel lined with endothelium; (*c*) leakage from the exploratory incision in the common duct, with inadequate drainage.

Careful peritonealization of the gall-bladder fossa will greatly reduce the hazard of bile leakage from aberrant ducts, and it is always wise to ligate the cystic duct well away from its junction with the common duct, leaving a good "tag" of duct beyond the ligature to prevent slipping. Leakage from the common duct has been reported to have occurred even from simple exploratory aspiration with a fine needle, and this is more likely to occur when the contained bile is under any pressure from duct obstruction.

In an analysis of causes of biliary peritonitis following exploration of the common bile duct, Allen and Wallace found two definite causes—closure of the common duct without provision for adequate drainage and, when used, failure of the drainage tube actually to drain bile after the operation. They point out that the mechanism is the same in either case—bile leakage from the common duct either through the sutured opening or around the non-functioning tube. It is most important for the surgeon to satisfy himself that the duct drainage tube, be it a Kehr "T" tube or an ordinary fine catheter, is

draining properly and is not in any way kinked before the abdominal wound is closed. They also point out how necessary it is to provide drainage from Morrison's pouch in front of the right kidney, to which area any bile leaking from around the tube will naturally gravitate.

In this connexion Whipple has drawn attention to one important cause of biliary peritonitis, and that is the tendency in the operating theatre after a drain has been sutured into the common duct and brought out of the wound for the nurse to clamp it off so that the escaping bile will not soil the dressings. Unless the clamp is removed as soon as the patient gets back to the ward there is a chance of increased pressure in the common duct causing bile leakage round the tube during the ensuing two to three hours. Walton, to whose writings on common duct surgery British surgeons owe so much, advocated drainage of the kidney pouch until the third or fourth post-operative day, when, if there is no evidence of bile leakage, the drain should be removed. He also advised drainage of the common duct in an average case of choledochotomy for stones when any degree of cholangitis is present for about ten to fourteen days, at the end of which time the duct tube should be gradually withdrawn, so that any bile still leaking may escape along the tube track.

Hepato-Renal Syndrome, Uræmia.

In this series five patients died between the fourth and tenth post-operative days with symptoms resembling uræmia. In three of the cases operation was undertaken for chronic cholecystitis and cholelithiasis; in the other two, for acute cholecystitis and empyema of the gall-bladder respectively. All patients were females over the age of fifty. In three cases post-mortem examinations showed advanced changes of chronic nephritis in the kidneys with cerebral œdema in one case and pulmonary œdema as terminal phases in the other two. In all five cases death was preceded by oliguria, vomiting and uræmic coma. Death from uræmic symptoms has long been recognized as one of the risks in biliary tract surgery, especially in elderly patients who suffer from arteriosclerosis. Heuer, in investigating the mortality in a large series of cases, estimated that 12% of deaths were due to associated cardio-renal disease. Cases in which uræmic symptoms are manifested after operation fall into two groups. In the first group there is definite pre-operative evidence of diminished kidney function, which proves unequal to the increased burden thrown on the kidneys by biliary infection and operation (Colp and Ginsburg). In these cases the renal condition is primary and the uræmia is similar to that which may be precipitated by any major operation performed on such a patient. In the second group there are no signs of renal disease before operation, but afterwards symptoms resembling uræmia develop with a fatal termination in coma in a few days.

In this group of cases renal changes are absent *post mortem* and it is difficult to account for the high blood urea content which is always found. A similar condition is found in certain cases of traumatic shock, in post-operative collapse, after long-continued vomiting in pyloric obstruction, and in some acute fulminating infections, especially those caused by the *Clostridium welchii*. Fishberg has suggested that these states are probably symptomatic of gradual circulatory failure, as there is always a low blood pressure. This causes a diminished renal blood flow and a resulting high blood urea. Clinically, progressive drowsiness, frequently preceded by mild delirium, is commonly seen and is of very grave import.

Liver Failure and Hyperpyrexia.

Three deaths were due to liver failure, one being associated with hyperpyrexia. In the two cases of liver failure the patients were females aged

fifty-five and sixty years respectively. Both had been deeply jaundiced for five and six weeks before operation, and both received the pre-operative preparation usual in such cases. In both cases operation revealed several common duct stones, and in one a fistula was present between the gall-bladder and pylorus. In both cases cholecystectomy and choledochostomy were performed. Both patients became comatose and died on the second post-operative day. Graham has pointed out that the patient with a damaged liver presents a risk, not only for biliary surgery, but for any surgery, no matter how trivial the procedure may seem.

The pathology in such cases is well recognized. The liver is usually the seat of biliary cirrhosis of various degrees. Central atrophy and cholangitis are present, and the liver is often a yellow, shrunken, bile-stained organ two-thirds the normal size. The trouble is obviously the inability of the liver to function properly because of obstruction in the avenue of excretion. In such circumstances the toxic products which the liver's function is to nullify and eliminate, accumulate in the blood and cause death, hastened by the trauma and metabolic upset of operation. The pre-operative treatment for such cases is now classic. Free intravenous administration of glucose, blood transfusions, and the administration of vitamin *K* and bile salts are essential in both the pre-operative and post-operative course of such cases, and the anæsthetic must be carefully chosen, not only, as previously mentioned, to avoid lung complications, but also to avoid liver damage.

I have personally found that after a pint of glucose has been administered intravenously a small dose of insulin—ten units, to "fix" the glucose—appears to help in the lesser degrees of liver failure and is particularly useful as a pre-anæsthetic measure in all cases of liver damage.

With use of the Quick test it has been found that even normal subjects undergo a marked fall in liver function, regardless of the variety of anæsthesia, when even simple surgery is carried out—namely, a 21% drop in liver function occurs under ethylene, a 28% drop under ether, a 49% drop under spinal anæsthesia (Boyce). Raydin, however, considers that the only factor in spinal anæsthesia which can influence the liver is the drop in blood pressure which accompanies it, with a corresponding lack of oxygen. Rich has shown that the liver is extremely susceptible to even slight degrees of anoxia, and it is imperative that there should be free administration of oxygen with whatever anæsthetic is used. These findings have been further confirmed by the researches of Bourne and his co-workers, who showed that the gaseous anæsthetics had no harmful effects on liver function unless administered with a deficiency of oxygen.

Death from Hyperpyrexia.—One death in this series occurred with a temperature of 104·5° F. on the day following operation.

The patient was a woman, aged forty-five years, who had been admitted to hospital with jaundice, a swinging chart and a tender swelling over the gall-bladder region. Shortly after admission her symptoms became rapidly worse, and an emergency operation was performed which showed a perforated gangrenous gall-bladder, with cholangitis and many stones in the common bile duct. Cholecystectomy and choledochostomy were performed and death was probably due to suppurative cholangitis.

No case of hyperpyrexial death occurred in any uncomplicated case of cholecystitis in which operation was performed. Various views have been put forward to account for this distressing phenomenon, sometimes seen in biliary tract surgery. Probably suppurative cholangitis explains the majority. In cases in which this condition is not present, however, other explanations are required. Sutton, experimenting on dogs, showed that ligature of the hepatic artery was followed by hyperpyrexial death, but post-mortem findings after such deaths in human subjects has failed to show accidental ligature of the hepatic artery. Boyce has advanced the theory that the type of liver

death which occurs occasionally within thirty to thirty-six hours after operation, with evidence of vasomotor collapse and hyperpyrexia, may perhaps be explained on the basis of an anaphylactic reaction. The patient, it is suggested, for hepatogenic or enterogenic reasons, may have become sensitive to the product of liver cell damage, a circumstance which becomes of extreme importance when, as happens at operation, the toxic substance is released into the circulation in massive doses. Recently it has been pointed out that these liver deaths greatly resemble the deaths from thyreoid crises in thyreotoxicosis (Lahey, Frazier *et alii*). Post-mortem changes of fatty infiltration in the liver and necrosis of liver cells are found in both conditions, and both conditions respond to intensive intravenous glucose therapy.

Other Causes of Death.

The remaining deaths in this series fall into a miscellaneous group comprising congestive heart failure (two cases), hæmatemesis (one case). In the two cases of cardiac failure both patients were in hospital receiving treatment for congestive failure when they developed acute cholecystitis. Both patients had a long history of gall-bladder symptoms and both had numerous calculi. In each case death occurred from cardiac failure several weeks after operation.

The patient who died from hæmatemesis was a man aged fifty-eight, who had been operated upon for a perforated duodenal ulcer some nine years previously. At cholecystectomy for acute cholecystitis the duodenal ulcer had healed. A very severe hæmatemesis occurred on the third day following operation, and post-mortem examination showed that it probably came from dilated œsophageal veins.

SUMMARY.

This review of surgical results is compiled from the records of a public hospital serving a city with a population of about 67,000 people, and a widespread rural area containing about the same number. At least half are engaged in agriculture or fruit farming, and their lives are governed by the seasons and the weather. Sickness is relegated to second place when it is a question of spraying trees or gathering the small fruit harvest. In some of the cases reviewed this is responsible to a considerable extent, I consider, for the late stages of the illness at which the patient is admitted to hospital. The object of this paper has been to present the immediate results of treatment for cholecystitis and cholelithiasis obtained locally, which resemble in varying degree results published elsewhere.

The investigation has shown that when surgical treatment is carried out for gall-bladder disease in the absence of inflammation and complications, it is attended by a low mortality rate of 2·15%. When the gall-bladder is inflamed the mortality rate for surgical treatment rises sharply to 18·4%. In the presence of common duct stones, with or without jaundice, the mortality rate was 20·5%. The controversial question of the best time for operation in cases of acute cholecystitis is discussed in the light of various published opinions.

From 5% to 20% of cases of acute cholecystitis will not subside and progress to gangrene and perforation. In these cases conservative surgery at an early stage will diminish the risk.

The actual causes of death in this series of cases are analysed, whether due to anæsthesia, liver or renal failure, peritonitis or hæmorrhage, or errors of surgical technique, and means to prevent their occurrence are discussed.

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THE SURGICAL TREATMENT OF MYOMATA OF THE UTERUS, WITH PARTICULAR REFERENCE TO MYOMECTOMY.[1]

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MYOMATA are among the commonest tumours in the body, and certainly the most common of uterine growths. These tumours are often incorrectly spoken of as fibroids and from long usage this term is firmly entrenched. Autopsy studies show that up to 20% of women over thirty years harbour myomata of varying sizes. Many of them are symptomless.

Many cases diagnosed as having fibroids need no surgical treatment. During the last ten years at the Royal Melbourne Hospital 487 patients with myomata have been seen, 376 of whom were treated surgically.

INDICATIONS FOR SURGICAL TREATMENT.

Weight and Size of the Tumour.

Some textbooks state that operation is indicated if the tumour reaches the size of seven months' gestation. In this country we are more radical than this. In young single women a smaller abdominal swelling causes embarrassment and is sufficient to justify surgical treatment.

Rapid Increase in Size of the Tumour.

Pain and irregular bleeding often accompany rapid increase in the size of the tumour and usually suggest a complication. These are common reasons for the patient first seeking medical advice.

Post-Menopausal Symptoms.

Pain and bleeding after the menopause due to an apparently quiescent tumour should always be viewed with suspicion. Carcinoma of the fundus frequently occurs in uteri which already harbour myomata.

Secondary Anæmia.

A falling hæmoglobin value with accompanying tiredness demands surgical attention. With the aid of blood transfusions, patients with a low hæmoglobin value, who are hence poor risks, can be made satisfactory operative risks. If the hæmoglobin value is below 55% a blood transfusion is indicated before operation.

Sterility.

Many women become pregnant despite the presence of uterine myomata. The cause of these tumours is unknown, but their close relationship with ovarian dysfunction is recognized. Some women, previously sterile, do become pregnant following the removal of these tumours. Once a decision is made that operation is necessary, the next thing to decide is what operation should be performed.

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FACTORS INFLUENCING SELECTION OF CASES SUITABLE FOR MYOMECTOMY.

Age of Patient.

The length of time during which the patient has been married rather than her actual age is important. A woman of thirty-five years with several children may prefer hysterectomy because of its certainty of cure, because it saves her from the annoyance of her periods and because it offers escape from pain, as well as the sure knowledge that she will not again become pregnant. On the other hand, a patient thirty-five years of age may have been recently married, or have no children, or because of the absence of her husband have had little opportunity of becoming pregnant. In such a case it is essential that the uterus be saved if possible. If the possibility of procreation, be it ever so remote, is removed from a woman, the psychological effect is great. A woman feels that she is better able to carry out her functions as a wife if she still possesses her uterus.

The commonest age group for myomectomy is twenty-five to thirty-five years. It is rarely performed for patients over forty years of age. Myomata are not common before twenty-five years. The youngest patient in my series was twenty-four years and married; the oldest was forty-six years, married, and complained of dyspareunia. She refused hysterectomy because of the reasons stated. The average age of the patients in my series was thirty-three years, and of the 66 patients presented, 46 were in the twenty-five to thirty-five group.

Number of Tumours.

Patients coming under the above heading are more suitable for operation if there are not too many tumours.

Bonney has reported cases in which he has removed over 100 tumours, and states that the number of tumours is not a bar to myomectomy. In my series the number of tumours was as follows.

2 patients had over 10 tumours.
1 patient had over 8 tumours.
1 patient had over 7 tumours.
4 patients had over 6 tumours.
3 patients had over 5 tumours.
2 patients had over 4 tumours.
7 patients had over 3 tumours.
4 patients had over 2 tumours.
42 patients had a single tumour.

Situation and Size of the Tumour.

Except for central cervical fibroids, the site does not matter. Any myoma can be removed. In nineteen cases the tumours were submucous. In one case the fibroid had recurred in the stump left following a supra-vaginal hysterectomy performed some ten years previously, when the patient was twenty-three years old.

The subperitoneal myomata are more easily removed. The size likewise is not a bar; usually big tumours are subperitoneal and present no difficulty. Small fibroids, because of the uncertainty of complete removal, are more difficult to remove, particularly in young patients, because seedlings left may make subsequent treatment necessary. If small tumours are distributed throughout the uterus, it is perhaps wiser to abandon myomectomy.

Interference Demanded during Pregnancy.

Rarely is interference necessary in pregnancy. Conditions such as red degeneration settle down with conservative treatment. Sometimes the abdomen is opened because of an error in diagnosis, a myoma having been mistaken

for a twisted ovarian cystoma with pregnancy. In such a case myomectomy could be attempted, due regard being paid to the risk of abortion, which would be lessened by adequate sedation, post-operative injections of progesterone, and conservative bowel treatment.

Occasionally red degeneration will not settle and the abdomen is opened. Should the uterus contain multiple tumours and only one is degenerating, it is better to remove that one alone rather than to disturb the pregnancy in searching for the others. They can be dealt with later. In one case I bared the membranes and removed the tumour without causing abortion.

Myomata causing obstructed labour are not often encountered. In such cases Cæsarean section is demanded. More often the tumour rises out of the pelvis and labour is uncomplicated and the tumour is dealt with on its merits at a later date. Elderly *primiparæ*, knowing that an operation will be needed at a later date to remove the tumour, may feel that Cæsarean section with removal of the tumours at the same time, subtotal hysterectomy being performed after the manner of Porro, is preferable because of the certainty of a live child. They feel that they are at least spared a long labour. Their point of view must be considered. Cæsarean section with myomectomy, unless the tumour is on a pedicle, is a risky procedure because the opening of the tissue planes in a pregnant uterus causes much bleeding; the wound surface is very great; involution is disturbed, the suture line leaks, blood passes into the peritoneal cavity, infection frequently follows and peritonitis and ileus ensue. Post-operative adhesions form.

It is preferable to deliver the child by the classical Cæsarean technique, sew up the uterus rapidly and perform subtotal hysterectomy. Convalescence is much smoother. Some authors advocate the performance of hysterectomy with the child *in situ*.

Bonney states that the tumour may be over the site of incision of the uterus. This can usually be avoided. He reports several deaths from Cæsarean section followed by myomectomy and concludes by stating that "if the surgeon has any doubts as to his ability to carry the operation through, or the patient's capacity to stand it, hysterectomy should be done".

Three patients of my series were pregnant at the time of myomectomy; one aborted, one went to term and was delivered normally, and the third, aged thirty-eight years, married for eight years, had only one of many tumours removed. After the condition settled down she elected to be delivered by Cæsarean section, for the sake of the baby.

FACTORS UNFAVOURABLE TO MYOMECTOMY.

Pathological Adnexæ.

It is wise to discuss with the patient before operation the possibility of myomectomy being abandoned. It frequently happens that the myomata are associated with pathological changes in the adnexæ, and in such cases it is preferable to abandon myomectomy and resort to hysterectomy. Plastic operations on the occluded tubes, if attempted with myomectomy, are not justified. Pelvic inflammation with possible pelvic abscess formation may be the result. Cystic disease of the ovary is not a bar. Such ovaries may be partially resected. This was done in nine cases. Parovarian cysts can be removed. In one case this was done and the patient subsequently had two children. Another patient, aged thirty years, had occluded tubes, both of which were removed, but the uterus was preserved for psychological reasons.

Degeneration in the Tumour.

Myomectomy need not be abandoned for any complication apart from suspicion of malignant disease, which fortunately is rare. At the Royal

Melbourne Hospital during the last ten years, of the 367 patients with uterine fibroids treated surgically, 30 have been treated by myomectomy (8%), which figure compares favourably with those of other series.

THE HISTORY OF MYOMECTOMY.

In earlier days ovariotomy was a popular operation, but it occasionally happened that a surgeon on setting out to perform ovariotomy was wrong in his djagnosis, for the tumour, instead of being the supposed ovarian cyst, was really a myoma with a pedicle, and it was removed by ligation of the pedicle in the usual way. By a process of evolution from operating on tumours with pedicles, then on tumours with broad short pedicles, to operating on tumours embedded in the uterus, and even on myomata inside the uterus, the surgeon has advanced to the stage at which he performs the present-day operation.

Towards the end of the last century the abdominal enucleation of fibroids was encouraged by some Continental and British surgeons. Previously attempts had been made at vaginal removal, and one notices today, particularly on the Continent, a survival of vaginal myomectomy and the great pains to which a surgeon will go when he could remove the tumour more speedily, easily and safely by the abdominal route. Early attempts at abdominal enucleation were attended by high mortality and the operation was nearly abandoned. The causes of death were sepsis and hæmorrhage. About this time hysterectomy had become a much more popular and common operation, attended by lower mortality rate in the hands of more surgeons. Of course the operation was subtotal hysterectomy. In 1898 Alexander, of Liverpool, read a paper in which he advocated abdominal myomectomy and many of the principles he described are followed in the operation of today. The arguments for the conservation of the uterus which he brought forward still apply. However, the discussion which followed the presentation of Alexander's paper was most hostile. Unabashed, a year later he reported eleven cases with one death. At that time the mortality for hysterectomy was given at from 12% to 30%, but once again his case reports did not find favour with the critics and the operation lapsed. Bonney states that although he was a young student in these days, he never saw anyone perform myomectomy, although isolated operations were being performed on the Continent.

In 1911 W. Mayo wrote a paper about the question, but it was not until 1922 that Victor Bonney began his crusade against the teaching that because a uterus contained fibroids it must be sacrificed. In fact his enthusiasm for the operation was such that he stated: "Any uterus with fibroids in it can be saved." Nowadays one cannot but pay tribute to Victor Bonney for showing us the scope of this operation in modern surgical practice. He has been closely associated with each stage in the improvement of its technique.

OPERATIVE TECHNIQUE.

Preparation of Field of Operation.

No operation demands more careful asepsis than myomectomy. Its scope has increased as our ideas of aseptic technique have improved. It has been found that such simple aids as rubber gloves and skin protection in the way of towels and rubber sheeting have helped in the advancement of myomectomy. The large area of wound surface makes for ready entrance of organisms. If myomectomy were attempted following a Cæsarean section the amount of wound surface would be immense. As the cavity of the uterus is frequently opened, some attempt should be made at vaginal preparation. The vagina is douched with "Zephiran", 1 in 400. In the theatre, with the patient in the

lithotomy position, the bladder is emptied, as before all gynæcological operations. A speculum is then inserted into the vagina, the cervix is drawn down; a cannula is inserted into the *os uteri*, and by means of a "Record" syringe five cubic centimetres of Bonney's blue are injected. This is a good antiseptic and fills the cavity, and on some occasions drips out of the ampullary end of the tubes, thereby demonstrating their patency. The blue also serves to show the outline of the cavity, which is often very distorted, and so aids its ready recognition.

Suturing.

For suture material catgut which is absolutely sterile must be used. Thread and other non-absorbable material act occasionally as foreign bodies, and I have on one occasion curetted out some thread from the uterus of a patient complaining of a vaginal discharge which followed such an operation. Likewise the suture material should be of good tensile strength and minimum diameter, because as it degenerates much serum collects in the dead spaces and is liable to cause post-operative fever. The wound demands careful suturing; it is sewn in layers of mattress sutures obliterating the cavities caused by the removal of the tumours from below upwards. This suturing should not be done hurriedly, and with improved methods of controlling the bleeding more time can be given to this important point. A running Lembert suture for the peritoneal layer should be tight enough to give firm apposition of the tissues and not to blanch the edges of the uterine incision.

Incision of the Uterus.

Alexander in his original paper in 1898 was correct in his advocation of an anterior incision. The essentials are that it should be possible to peritonealize the incision and that hæmostasis should be good. The former will be elaborated later. From an anterior incision, blood, if it should leak, forms in the utero-vesical pouch, out of harm's way, and not in the pouch of Douglas, where troublesome adhesions may follow.

The advantage of one incision to remove all the fibroids is obvious. Even if the fibroids are in the posterior wall it is not a disadvantage to open the cavity in order to remove them. Indeed it is often essential to open the cavity, and I do it as a routine measure, for it is very annoying to find that a patient who has presented with menorrhagia and a palpable tumour, still has the menorrhagia after the tumour has been removed, because an unsuspected polypus was present. Likewise, I find that when the uterine cavity is opened, the patients run a less febrile course than do those whose uterine cavities have not been opened, because unavoidable collections of serum in the obliterated spaces drain into the cavity and out through the cervix. Thus the presence of a small blood-stained discharge two or three days following the operation is not alarming, but is rather welcomed, for in such circumstances the patients run a less febrile course than otherwise. With the cavity opened one should feel the uterine wall between the finger and thumb for any small seeds. Bonney states that even those the size of a mustard seed will grow, and he has removed over 100 and still preserved the uterus. Whilst most of us are not perhaps so diligent in our search, it appears that myomectomy need rarely be abandoned, if its indications are strong enough, because of the number of tumours. I feel that occasionally we miss the little tumours, and in young people these undoubtedly grow, making a second operation necessary at a later date. Bonney feels that if the tumours are not present as seeds at thirty-five years they will not show up later; but, of course, most of our operations are done before the patients are thirty-five years of age.

Tumours in the Anterior Wall of the Uterus.

Myomata in the anterior uterine wall can be removed by the medial anterior incision, for the tumours are sufficiently mobile to allow of their being pushed towards the incision or of a side track being made with a scalpel to enable them to be extracted. Lateral fibroids may be removed in this way.

Tumours in the Posterior Uterine Wall.

Tumours just under the peritoneum are removed from the posterior surface of the uterus and the bare area is best closed with a pursestring suture. Interstitial tumours on the posterior wall must be approached through the cavity if they are small, or by means of the hooded flap incision when they are larger.

The Hooded Flap Incision.—An incision is made transversely across the uterus, posterior to the line of the tubes; the capsule of the fibroid is opened and the tumour is enucleated. The portion of uterine wall that covered it hangs down behind like a monk's hood. By means of several layers of sutures, the hood is now sewn down over the anterior wall of the uterus covering it. Much cutting away of redundant tissue is necessary.

Myomectomy by Block Incision.

I have never tried myomectomy by block incision because I feel that the pathological uterus which demands it is better removed.

To split the uterus sagittally and to reconstruct it completely hardly warrants description. The risk of leaving a few seeds is great and a suture line extending from the back of the uterus over the fundus and down the anterior wall is full of dangers from adhesions. Subsequent pregnancy, if any, would be treated by Cæsarean section.

Cervical Fibroids.

Cervical fibroids are difficult to remove because a tourniquet cannot be applied below the tumour. If other fibroids are present in the body, it is better to remove the cervical fibroid first, because after its removal the tourniquet can be applied.

For central cervical fibroids myomectomy is exceedingly difficult. Great care must be taken to work in the correct plane and to push the bladder well down before the capsule if the tumour is incised. It may be necessary to bisect the uterus and to shell out the tumour. Hæmostasis is obtained by two long light bowel clamps applied along the broad ligaments. Displacement of the ureters is common and care must be taken, for sometimes they are stretched out over the tumour and easily missed. Because the cervix is elongated the cutting away of redundant material is a difficult procedure. For the less expert, hysterectomy is probably the easier and safer procedure.

Naturally after removal of the fibroids a much distorted uterus remains. Redundant tissue must be cut away and an attempt made to make the uterus as normal as possible. It is remarkable how after a few years a uterus which appeared grossly distorted has regained its shape. It is necessary to cut away as much tissue as possible, because a large, bulky uterus invites hæmorrhage and eventually sepsis, and tends to flop back into the pouch of Douglas. For this reason, and others, some shortening of the round ligaments is usually combined with myomectomy, to keep the uterus forward. Some advise ventrofixation, but I have not found this necessary. In order to prevent the uterine incision from becoming adherent to small bowel, an effort is made to cover the incision by peritonealization.

Peritonealization.

Peritonealization may be considered as used for anterior and for posterior incisions.

For anterior incisions use may be made of one of the following: (*a*) plication of the round ligament across the incision; (*b*) opening of the vesico-uterine fold and raising of the flap from the lower segment, that it may be sutured over the incision; (*c*) ventro-fixation with use of the anterior abdominal wall to cover the incision.

For posterior incisions the following may be used: (*a*) to bring the round ligament under the tubes and suture over the incision posteriorly after the manner of Baldy Webster; (*b*) the planning of an adhesion to the pelvic colon, which is perhaps better than a chance adhesion of small bowel with resulting risk of obstruction; (*c*) the mesosalpinx may be swung in and sutured to the incision to cut it out from the general peritoneal cavity.

Hæmostasis.

Hæmostasis originally was the bugbear of the operation and did more to retard its progress than any other factor. Various means have been tried to overcome bleeding. Originally ring forceps were placed on each ovarian vessel and forceps on each uterine artery. Sometimes this meant opening up the leaves of the broad ligament. Sometimes a temporary suture around the uterine artery was used. Bonney in his earlier cases used these methods until he devised his familiar clamp, which compressed the uterine arteries temporarily. These clamps are expensive and it was soon found that the size of the cervix varied, and so the complete gynæcologist had to be armed with several clamps of varying sizes. I think that not having these expensive clamps has been the main reason why the occasional surgeon has not given myomectomy proper attention but has resorted to the more familiar hysterectomy. I use an ordinary piece of rubber tubing, which is inexpensive, adjustable and suitable for all cases, and it does not have the disadvantage of having handles which tend to get in the line of vision. Likewise it does not slip. Furthermore, it is within the reach of all surgeons. I apply the rubber over the tubes and over the lower segment, thereby compressing both ovarian and uterine arteries. I use a similar technique to control bleeding in a classical Cæsarean section and abdominal hysterectomy, and find it effective. Because there is no blood loss, there is plenty of time to sew up incisions effectually.

The vessels are too well embedded to be damaged, gangrene does not occur, and no case of embolism has been recorded in the series, and from the number of subsequent pregnancies the tubes are not damaged. As a further aid to hæmostasis I use ten units of "Pictocin" or one cubic centimetre of "Pituitrin" or five mils of ergometrine, injected into the uterus by means of a sterile syringe.

Tubal Patency.

Because the primary idea of conserving the uterus is to enable the woman to have a family, it is desirable to know whether the tubes are patent or otherwise both before and after operation.

Before Operation.—If tubal patency cannot be proved, the only function of myomectomy is to let the patient think she is still womanly and that all her desires are not removed. I feel that it is useless to attempt plastic operations on the tubes and then to remove the fibroids by myomectomy in the vain hope of pregnancy. I have done this on one occasion with dismal results. The inflammation which occluded the tube flares up with surgery and the adjacent

raw area in the uterus is a potent source of danger. Pelvic abscess, requiring a posterior colpotomy, pelvic cellulitis and chronic pelvic inflammation have been my experience in such cases.

After Operation.—It is desirable to know whether the tubes are patent, because you may have occluded the isthmial portion by an over-zealous search for fibroids and suture obliterating the tubes. Just as it is our experience that after insufflation of the tubes from below, patients previously sterile sometimes conceive, so also do they when insufflation is carried out under vision from above. For this purpose I use a 10 cubic centimetre syringe and force air down the ampullary end. The tube can be seen to distend and the air can be heard to pass. Likewise Bonney's blue inserted at the start of the operation shows tubal patency on occasions and serves to outline the isthmial portion of the tube.

RESULTS OF MYOMECTOMY.

Relief of Symptoms.

Menorrhagia.—Twenty-one patients presented with menorrhagia of varying severity and duration, the longest history being seven years. Eighteen patients reported complete cure. The condition of three was not improved, the cause of failure being that some seedlings were left behind which subsequently caused symptoms. In one of these cases a Cæsarean section was performed at term, for the sake of the child, and the uterus and fibroid were removed at the same time.

Sterility.—Twenty patients stated that sterility was their leading symptom. Of that number, fifteen were desirous of becoming pregnant. Nine conceived, having twelve children, and six have not become pregnant. Of the remaining five, three are still single or are not trying to become pregnant, and two cannot be traced.

Abdominal Swelling.—Seven patients presented with abdominal swelling. All were relieved.

Pain.—Of the fourteen patients complaining of pain and backache, twelve were relieved. In one case pain returned after seven years, and examination revealed a recurrence of the tumour. Hysterectomy was performed with relief. In one case the backache was not relieved.

Dysmenorrhœa.—Of the ten patients presenting with dysmenorrhœa, seven reported improvement, one temporarily, and in two cases there was no follow-up.

Repeated Miscarriage.—Four patients presented after having miscarriage, one of them two miscarriages. In three of these cases the desire to have a full-time child caused the patients to seek advice; in the fourth case pain was the leading symptom. After myomectomy two patients became pregnant and were delivered of full-time children.

Dyspareunia.—The one patient who complained of dyspareunia was cured.

What Percentage of Patients Need Secondary Operation?

There has been a recurrence of symptoms sufficient to warrant further operations in three of the sixty-six cases presented—that is, in 4·5%. Hysterectomy was performed in these cases five, six and seven years later. It is possible, of course, to repeat the myomectomy, but usually hysterectomy is preferred, as the patients are older, and in one of the cases mentioned pregnancy had occurred.

In one case a subtotal hysterectomy had been performed on a girl of twenty-three years, and ten years later a fibroid occurred in the stump and

was removed by myomectomy. Bonney states that 3% of patients need secondary operation, but thinks that if a patient is over thirty-five years the recurrence rate is minimal. My three patients with recurrences were thirty-three, thirty-four and twenty-nine years of age at the time of primary operation.

Obstetrical Review of the Cases Subsequent to Myomectomy.

Rupture of a myomectomy scar is rare, because during the operation, providing that the hæmostasis is good, the wound can be leisurely and surely sewn.

Cæsarean section is justified in the case of an elderly *primipara* who has some disproportion in the fœtal and pelvic measurements, as labour puts considerable strain on the uterus and rupture is more likely to occur, particularly if the uterine muscle has been badly cut in order to remove tumours.

Of the sixty-six patients presented, thirty-four were desirous of pregnancy following operation, seventeen remained single and fifteen were not anxious to become pregnant. Of the 34 patients desirous of pregnancy, fifteen subsequently became pregnant and produced 25 children, including two sets of twins. There were two ectopic pregnancies.

Of these 15 patients, five were delivered by Cæsarean section, one because of a central *placenta prævia*, one on account of a recurrence of the tumours and it was elected after discussions to perform a Cæsarean hysterectomy, and three because they were elderly *primiparæ*, all over thirty-five years of age, and Cæsarean section was elected for the sake of the baby. These three patients had five, three and three submucous tumours removed respectively. The remaining ten patients had normal deliveries.

Mortality and Morbidity.

Sixty-six cases are here presented without a death. The lessening in the mortality rate is due to improved aseptic technique, better preparation of the patient, improved hæmostasis and careful peritonealization of the uterine incision.

Fifteen patients were febrile for two or more days.

Causes of morbidity were: chest complications in three cases, wound infection in three cases, post-operative intestinal obstruction in one case, and injury to the bladder in one case. The average period of hospitalization was 21 days.

SUMMARY.

1. The indications for surgical treatment of myomata of the uterus are discussed.

2. The scope of myomectomy is analysed.

3. The important details in technique are described.

4. A series of 66 cases are surveyed. There were no deaths and the results were satisfactory.

SECONDARY HÆMORRHAGE.[1]

By W. A. Hailes,
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The subject of secondary hæmorrhage is dealt with indifferently in many textbooks, is badly answered when asked at examinations, and is feared, and rightly so, by many well-qualified surgeons.

In civil practice this alarming complication of traumatic surgery is not very frequently encountered. This, no doubt, explains why first principles are so frequently broken and the forfeit paid. In the case of a large peripheral artery this may amount to the loss of a life or limb. The aim must be to save both. To achieve less is a surgical catastrophe, although, in some instances, excusable.

The Artery and its Treatment.

In the peripheral arterial system the size of the vessel involved is one of the principal factors that determine the seriousness of a case of secondary hæmorrhage. Bleeding from small branches of the main trunks will often cease spontaneously and requires nothing more than a liberal dressing and the pressure exerted by firm bandaging. It is not suggested that immediate operation should be performed in all cases. The degree of urgency depends on the rapidity of the bleeding and the amount of blood lost. A sudden gush implies an opening in a large vessel and demands urgent action; a continuous trickle may prove just as dangerous, but the need for operative interference may not be immediate.

In this paper emphasis is directed to the treatment of secondary hæmorrhage from large vessels. The pathology should be known to all. Infection around the wall of an artery or ligated stump erodes the vessel. Contraction and retraction of the coats are impossible, as the result of infiltration; the artery is fixed in the wall of the abscess cavity. The thrombus that tends to form over the opening is soft and soon eroded or forced out by the reestablishment of the blood pressure following adequate resuscitation. A bright red stain on the dressing or a small bright bleeding should be a significant warning of what is to follow and is an indication to tie a tourniquet to the foot of the bed. The rapidity of the bleeding may necessitate the use of the tourniquet or even digital pressure inside the wound while the patient is transferred to the theatre. Often with the fall of blood pressure the bleeding temporarily ceases.

If the limb and life are to be preserved there are some first principles to be remembered.

Prolonged pressure, in the form of packing, tight enough to arrest arterial bleeding from large vessels, will result in extension of the inflammation and further ulceration and consequently a larger hole and a more severe hæmorrhage.

If the main arterial supply to the limb has been interrupted or embarrassed, the extremity must not be elevated.

The blood pressure must be restored by reconstituting the blood volume. The fear that the bleeding may recur is no excuse for either omitting transfusion or restricting the amount of the transfusion.

[1] Accepted for publication on October 19, 1945.

Secondary hæmorrhage is liable to recur unless the vessel is ligated or in the case of a lateral opening the vessel tied above and below and divided. The aversion of some to this procedure can be ascribed only to fear either of failure to find the open vessel or of blood. It is admitted that in a small percentage failure to locate the site of the bleeding may eventuate, that in the axilla the anatomical hazards are sometimes too great to persist, and that adequate exposure of the first inch of the anterior tibial artery may be impossible. The friability of the arterial wall is not an insuperable difficulty. If adequate exposure of the vessel is obtained, little difficulty will be experienced in effecting secure ligation.

In a direct attack on the bleeding vessel, the wound should be opened or enlarged and the clot, if present, carefully removed. The clot becomes progressively brighter as it is traced inwards and sometimes leads to the opening. In the case of the larger arteries, the complete absence of any attempt at contraction and retraction is striking; when the bright clot is removed or the wound opened widely, the polished endothelial lining will often be seen glistening. Alternatively, if a tourniquet or digital pressure is still in use, this should be relaxed and the bleeding point located.

Direct closure prevents the recurrence of the bleeding when the collateral circulation is established and removes any possible objection to adequate restoration of blood volume, which, by raising the blood pressure, is probably the most important factor in maintaining the vitality of the limb. Adequate drainage is provided.

What is lost if the attempt locally is a failure? In the case of an amputation stump, nothing; in an extremity still *in situ,* if care is taken to avoid the adjacent nerves, nothing. The wound leads to the bleeding vessel; open the wound or the partially healed scar, or enlarge a sinus or untreated wound with that area as the centre of the incision.

Failure of a direct attack is soon obvious and there still remains the other alternative, proximal ligation.

What is demanded of the surgeon in a direct attack? Accurate anatomical knowledge and the ability to apply it from all aspects, reasonable manual dexterity, the ability to make quick decisions and to act on them, and, above all, resolution and the will to win. The condition is one from which the patient should recover, the treatment anything but ended when the vessel is tied. In the realm of traumatic surgery there are few if any more fascinating battles; everyone concerned is agog when the large vessels are popping. There is but one regret—the stakes are too high: success on the one hand and a life or a limb on the other.

The aversion of some surgeons to a direct attack on the vessel can be readily understood. If a simple method, such as proximal ligature, will give equally good results no one would willingly choose a more difficult and uncertain procedure.

What would those who favour proximal ligature do when the common carotid is involved? Proximal ligature will not control the bleeding; ligation above and below will. If this can be carried out in the neck, why not elsewhere?

It may well be that the occasional surgeon in remote areas, with little help available, may elect wisely to perform proximal ligation and hope for the best.

Proximal ligation as a method of choice is condemned because the opening remains unclosed and the abscess cavity is drained inadequately. Effective drainage of the area involved is most important. In some cases in which proximal ligation has been performed and the bleeding area left undisturbed, a dirty red discharge persists sometimes for weeks. This discharge is bright

enough to lead one to believe that the hole in the vessel is still leaking. Adequate drainage is surely necessary for healing and in cases so treated is not provided. The haunting fear that the hæmorrhage will recur when the collateral circulation is reestablished is a barrier to adequate restoration of blood volume so necessary to safeguard the vitality of the limb.

The artery must never be tied in continuity; always ligate in two places and divide it. This takes some of the thrust off the site of the ligature; the proximal end can be seen to elongate with each pulsation. In a wound that may become infected this diminishes the risk of bleeding from the site of the ligature. In some anatomical areas all your clinical acumen may be needed to decide which artery to tie. This is especially so in the thigh. Is the hæmorrhage from the superficial femoral or from the profunda? This may be an all-important detail; an incorrect decision may determine the onset of gangrene. There is evidence to show that proximal ligature should be performed close to a large branch; a blind stump that absorbs and dissipates some of the arterial thrust, so badly needed to open the collaterals, should not be left. It must be remembered that an extensive dissection is not indicated in a septic extremity. Should a branch be seen, pass the ligature immediately distal to it.

TREATMENT OF THE VEIN.

In the event of a direct attack on the opening in the artery proving successful, no attempt is made to tie the vein. Anatomical details are obscured and there is no occasion to make trouble by dissecting in an inflamed area.

Should ligation of the accompanying vein be performed? I have never deliberately tied the accompanying vein. Surgeons in the Australian Military Forces were allowed to follow their own inclinations in this problem; few tied the vein. It is realized that this practice is contrary to former teaching and to the figures quoted by Makins. It is significant, however, that Ogilvie states that ligation of the vein was not practised in the Mediterranean Expeditionary Force during the period he acted as consulting surgeon. If the so-called Henle Coenan phenomenon is present there is no necessity to consider tying the main vein. There is certain experimental evidence to show that the collateral arterial pressure is raised after the vein has been ligated.

When the bleeding has been controlled, activity is directed towards further resuscitation of the patient and the prevention of gangrene of the limb. This is effected by: (*a*) reconstitution of blood volume and consequent restoration of normal arterial pressure; (*b*) a horizontal, not an elevated, position for the limb; (*c*) chilling or injection of the lumbar sympathetic chain, of which I have had no experience. It is customary, however, to apply as little dressing as is consistent with safety and to leave the limb or splint otherwise uncovered.

The reaction of the limb below the site of ligature varies considerably. In some instances there are few abnormal sensations. In others, complaint is made of paræsthesia, varying from numbness to severe pain, anæsthesia and complete lack of feeling, cold *et cetera*. Forty-eight hours or a little later appears to be the critical period; in some cases the return to normal sensation is almost sudden and dramatic—the patient may be very anxious about the state of the limb and half an hour later will volunteer that it feels quite normal.

My experience has been that recurrence of hæmorrhage following proximal ligation is not infrequent and that almost complete security of outlook results from tying the bleeding vessel.

The exceptions to a preliminary direct attack are hæmorrhage from the branches of the internal iliac artery in the buttock and from some of the branches of the external carotid. In this emergency, if the bleeding is deeply situated, immediate ligation of the internal iliac or external carotid artery is indicated. To ligate the internal iliac artery at or near the sciatic notch is very difficult and often impossible by an approach from the buttock.

CLOSED SECONDARY HÆMORRHAGE.

Infection around lodging foreign bodies which have not been removed, or along the track of through-and-through wounds sometimes gives rise to secondary hæmorrhage, and yet very little, if any, blood escapes to the exterior. The narrow track retards the escape of the blood, clotting occurs and seals the track. The blood is then extravasated into the tissues at a pressure approximating that of the arterial pressure at the time. The consequences are pain, often severe shock, and a very great exacerbation of the infection. I have seen two cases in which severe gas infection occurred in the area. It is impossible to tell whether the wall of the vessel was damaged at the time of the injury. Symptoms of the extravasation may occur at any time after the first three or four days, and are characterized by local pain and swelling and a degree of shock incommensurate with what has occurred. The condition of the patient deteriorates rapidly, the pulse rate rises to 120 per minute and the temperature to 102° F.; the patient appears very ill. This complication occurred in both thighs in one patient, the subject of multiple bullet wounds. Although the second hæmorrhage on the left side was not very large and occurred seven days later than that on the right side, the associated collapse was so severe that it was several hours before operation could be undertaken, and despite active resuscitation a fatal issue was but narrowly averted.

There can be no doubt of the treatment of this condition. Tension must be relieved, the blood clot evacuated, the vessel secured and adequate drainage provided. The incision must be made over the site of the swelling; if this can be done by enlarging the wound of entry or exit, it is advantageous to do so. If a wound of entry only is present, the track of the foreign body should lead to the site of the bleeding. If the presence of a foreign body or the site of the swelling indicates that the bleeding is situated far from the wound of entry, a more appropriately situated incision should be made.

It may be advantageous in some areas to pass a temporary stay ligature around the main artery to that area—for example, the *profunda femoris*—before the incision into the hæmatoma is made.

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DISCUSSION.

R. A. MONEY: As a general rule I do not favour a direct attack on the bleeding vessel in the wound in cases of secondary hæmorrhage. This type of hæmorrhage usually occurs in the presence of sepsis, and at times tourniquets cannot be applied; therefore I consider that the search for the bleeding point can be successful only with a skilled surgeon, under ideal conditions, where adequate lighting, suction, instruments, assistance *et cetera* are available. It is thus rarely practicable in forward surgical units. The cases in which the clot can be easily followed down to the opening in the artery must be the exception rather than the rule.

With deep wounds of the buttock, where penetration to the pelvis is likely, and in the upper part of the neck, lower jaw and mouth, I agree wholeheartedly with the opening speaker's closing remarks, that proximal ligation is the only thing to do, and instances were observed in the Middle East in which failure to ligate the internal iliac artery with buttock wounds cost lives, whereas its early ligation was followed by good results. Furthermore, the danger of opening up fresh tissues and fascial planes in the presence of acute sepsis to give access to the bleeding vessel in small deep wounds cannot be ignored, although admittedly this search frequently discloses the presence of foreign bodies and dead tissues not previously removed, and also affords an opportunity of providing free drainage for the wound and its discharges. The practice of plugging septic wounds with gauze to control hæmorrhage must be avoided at all costs.

In my experience, ligation of the artery at a point as proximal to the bleeding point as is consistent with access through a clean route and the provision of adequate local treatment and drainage to the wound are the safest plan and rarely fail. A direct attack may fail to disclose the bleeder, and even if the bleeder is controlled, early digestion and ulceration of the ligated vessel and its clot can be expected in the presence of sepsis.

Concealed hæmorrhage always causes trouble in diagnosis and treatment. Small through-and-through wounds of the popliteal fossa and calf are misleading in this respect; and the mistaken diagnosis of a swelling in the vicinity of the knee as due to traumatic synovitis instead of to a hæmatoma from a torn popliteal artery and the application of a full length plaster cast cost at least one soldier his leg in the Alamein battle.

The danger of gangrene when the main vessel to a limb has been ligated is always a real one. I have had no experience with chilling the limb to reduce its metabolism, but feel that excessive warming and bedclothes should be discarded. Injections of sympathetic ganglia with alcohol will rarely be practicable at the time of the operation for ligature, as the patient will probably be too ill for the necessary observations to be made and to be placed in the necessary postures for these procedures.

Sympathetic denervation of a limb is of value chiefly as a prophylactic measure in those cases where it can be carried out some time before the arterial ligation becomes necessary. In other cases the only way to procure any sympathetic denervation is to cut and tie the artery, rather than ligate it in continuity. The other safety measure that I wish to advocate is ligature of the main vein, where it accompanies the artery. In most cases gangrene is assisted by the fact that the limited amount of blood which enters the limb by collateral circulation is returned too quickly by the fully patent venous system, and venous ligature assists in preventing this. I agree that posture of the limb is an important factor for the same reason, and reiterate that the limb should never be allowed to be above heart level and can on occasions with advantage be placed below it to prevent a too rapid venous return.

Finally, I stress the importance of making up fully and rapidly the blood lost to the circulation in secondary hæmorrhage and draw attention again to the importance of Major Giblin's observations and experiences in the Western Desert, where larger quantities of blood were given much more rapidly than ever thought feasible before, with gratifying results.

LIEUTENANT-COLONEL N. R. WYNDHAM: I wish to support Brigadier Hailes. At least in two situations proximal, as well as local, ligating of important vessels is sometimes necessary. This applies particularly to the ligating of the external iliac and subclavian arteries for hæmorrhages around the proximal end of the thigh and arm respectively.

R. OFFICER: I agree with all that Brigadier Hailes has said. Secondary hæmorrhage is apparently less frequent than in the last war, and is probably due to the use of sulphonamides. Most of the wounds of large arteries which cause trouble are caused by small missiles—for example, bullet and small shell or mortar fragments. Because the wounds are small the possibility of arterial damage is often forgotten, with the result that an aneurysm develops. It is recommended that wounds caused by small missiles shall be thoroughly excised whenever the direction of the track indicates that the missile has passed close to the main artery of a limb.

THE FLUID BALANCE CHART.[1]

By CHARLES GALE,
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OF the various problems concerned in the maintenance of an accurate balance between the fluid and electrolyte loss and intake in surgical cases, two of practical importance are discussed in this paper: firstly, the calculation of the quality and amount of fluid and electrolyte administered each day, and secondly, the methods of charting such intake against the various routes of fluid and electrolyte loss.

THE CALCULATION OF THE FLUID AND ELECTROLYTE REQUIREMENTS.

Existing methods for the calculation of fluid and electrolyte requirements fall into one of two groups—namely, that in which the calculations are made according to the variation in the results of biochemical estimations, such as the hæmatocrit findings, the plasma chloride content, the plasma protein content,[14][28] and the shift in the electrolyte pattern;[14][29] and that in which the calculations are based mainly on the clinical response of the patient, biochemical tests being used to a relatively minor degree and interpreted with caution. Coller and Maddock's[2] method, which has been widely adopted and is quoted in many textbooks, belongs in the latter group. The depletion existing at the time the patient comes under treatment is corrected by them, with the aid of formulæ based on biochemical investigation. The subsequent maintenance of the fluid-electrolyte balance is on a volume-for-volume replacement plan, biochemical investigations playing a relatively minor part. They state: "The staff has learned that with the proper carrying out of the procedure (volume-for-volume replacement) the electrolyte chemistry is almost invariably normal." It is a modification of their method that has been used by me during the last three years. Owing to staff and other difficulties, plasma chloride, hæmatocrit and plasma protein estimations were not available, the clinical condition of the patient, the fluid balance chart, and simple urine ward tests being the only guides to treatment. Nevertheless, clinical results were satisfactory and it was only occasionally that the absence of biochemical confirmation of our clinical impressions was regretted.

Biochemical data can be dangerously misleading. Thus Coller[2] in 1940 described his "clinical rule" for estimating the dose of sodium chloride necessary to correct the salt depletion existing in conditions such as high intestinal obstruction in which vomiting had been marked. The "clinical rule" stated that "for each 100 mgms. the plasma chloride is below 560 mgms. per 100 c.cm's, give ·5 Gm. of salt per kilogram of body weight". But in 1944 Coller[16] retracts this "clinical rule" with these words: "These cases have convinced us that the use of the 'clinical rule' is dangerous . . . and that it should not be employed. It is recommended that the correction of fluid deficiency states be made upon the basis of the physiologic response to test doses of the appropriate salt solution rather than upon the basis of the plasma chloride, the CO_2 combining power, the N.P.N., the plasma protein or the hæmoglobin levels."

[1] Accepted for publication on February 6, 1946.

CONDITIONS REQUIRING PARENTERAL ADMINISTRATION OF FLUID AND ELECTROLYTES.

Excluding special problems associated with conditions such as burns, surgical conditions requiring parenteral administration of fluid and electrolytes fall into one of three groups:

Group A. Cases in which there is a satisfactory water and salt balance, but in which excessive loss is expected to occur from post-operative vomiting or continuous alimentary aspiration, as in the early post-operative period of severe abdominal procedures, such as gastrectomy.

Group B. Cases in which the patients, when first seen, are suffering from depletion of both water and salt—for example, in high intestinal obstruction.

Group C. Cases in which the patients, when first seen, are suffering from lack of water but not salt. For example, insufficient water intake has been present from either voluntary abstention or inability to swallow.

Group A.

A few days before operation the patient is placed on a fluid balance chart and all intake and output are recorded. During the operation blood or plasma is administered if necessary and charted. At the termination of the operation the fluid and salt to be administered during the next twenty-four hours are calculated in such a way as accurately to provide for: (*a*) the loss by vaporization that is expected to occur, (*b*) the loss in the urine that is hoped will occur, (*c*) the loss that has occurred during the operation as a result of the operative trauma.

1. Loss by vaporization—that is, by the skin (both visible sweating and invisible loss) and by the expired air—is mainly loss of water. Ready biochemical estimation of the amount is impracticable. I have estimated this at 70 ounces for the first twenty-four hours after operation, as suggested by Coller and Maddock.[2] The amount of sodium chloride lost in the sweat again cannot be readily determined by biochemical test, but Coller and Maddock state that it is negligible in the absence of visible perspiration. The salt content of sweat varies between 0·2% and 0·5%, the percentage rising as sweating becomes more profuse.[22]

Wangensteen[20] states that "the salt content of sweat formed during anæsthesia averages probably 3 Gm. per litre". Therefore, for the twenty-four hours it is estimated that the administration of 70 ounces of fluid will be necessary to balance this loss, and that as the salt loss is small, it should be given as water, in the form of 5% glucose in water.

2. In regard to the loss in the urine that is hoped will occur, Wangensteen gives this as 25 to 35 ounces, Graham as 30 ounces, Coller and Maddock as 35 ounces, and Mason, Blalock and Teitleman independently give it as 50 ounces. Again, the salt loss will probably be slight, the kidneys, provided their efficiency is satisfactory, holding it back if there is any tendency to a negative salt balance. Therefore it is provided for as water, as 5% glucose in water. Although desiring an output of 35 or more ounces, I allow a dose of 30 ounces, as this *plus* the allowance for vaporization totals 100 ounces—that is, five pints, which is a convenient figure.

3. The loss that has occurred during the operation as a result of the operative trauma again can only be estimated, and in the average case one and a half pints are regarded as being adequate. This figure will be modified according to any blood or plasma that has been given during the operation or is to be given subsequently. In the absence of these, one and a half pints in the form of normal saline solution are taken to provide not only for operative trauma loss, but also for the slight salt loss that has occurred in

the sweat during anæsthesia, and that will occur in the vaporization and the urine in the next twenty-four hours.

Oppenheim and others[20] accurately determined the blood loss at operations performed by one surgeon of their group and found the averages for major abdominal procedures to vary from four ounces for sigmoidectomy to 13 ounces for abdomino-perineal rectal resection.

Coller and others,[27] following a review of the literature, concluded that the blood losses in nearly every operation were greater than expected by the surgeon.

Thus in the average case, at the termination of the operation an order is left for the administration during the next twenty-four hours of five pints of 5% glucose in water and one and a half pints of normal saline solution.

At the end of the first twenty-four hours reference to the fluid balance chart gives the guide to the calculation of the requirements for the second twenty-four hours. Provision has to be made for:

1. Vaporized loss expected to occur. If the humidity of the ward is above normal, the patient has visible perspiration, is febrile or is suffering from hyperthyreoidism, the amount is estimated at 60 ounces at least. Recommendations by various writers vary from 50 to 80 ounces in febrile conditions and from 50 to 100 ounces in hyperthyreoidism. If none of the above factors are present, 30 to 50 ounces, according to the size and activity of the patient, are recommended by Coller and Maddock.[12]

It is probable that in some cases the minimum figure of 30 ounces is much too high. This is suggested by the following case.

CASE I. H.R. suffered from hyperplastic tuberculosis of the ileo-caecal region. He was in a winter environment, but his room was comfortable, with central heating. He was admitted to hospital on June 17, 1944, suffering from partial intestinal obstruction with distension but no vomiting. He had not vomited when the fluid balance chart (Figure I) was commenced. To obtain decompression prior to operation a Miller-Abbott tube was passed at 6 p.m. on June 22. Operation consisting of ileo-transverse colostomy was performed at 11 a.m. on June 27 with the Miller-Abbott tube still in position; and for the following week fluid-electrolyte balance was maintained intravenously in conjunction with continuous aspiration via the tube, the object being to protect the anastomosis suture line. Both aspiration and intravenous therapy were discontinued on July 3, the patient being very comfortable, and on this date the progressive water balance was −183 ounces. Nevertheless the patient was clinically very well, with no suggestion of dehydration or salt lack. Although the necessity for accurate charting had ceased, the chart was continued for a further week, as it was suspected that the daily allowance of 30 ounces for vaporization loss was much too high. The highest temperature for the day is indicated in Figure I. The calculations for vaporization loss were as follows. Thirty ounces were allowed for each day except those when the temperature was elevated and those of the immediate post-operative period. Operation was at 11 a.m. on June 27. Fifteen ounces were allowed for the eleven hours before operation and 35 ounces for the approximate twelve hours after operation to midnight of the operation day. Thirty-five ounces were allowed for the morning of the next day (that is, for the second half of the twenty-four hour post-operative period) and 20 ounces for the subsequent twelve hours. The progressive fluid balance was positive on only one occasion, namely, shortly after operation. It thereafter steadily became considerably negative.

In spite of this, and except for the temporary post-operative oliguria, the urinary output was consistently satisfactory; and from July 3 the patient was continuously well clinically. There appears to be no doubt that he did not suffer from either salt or water depletion. If slavish insistence on a positive balance had been insisted upon, he might have exhibited signs of intolerance. Observation of other patients confirms this conclusion that in many cases a much lower allowance than 30 ounces per day is adequate to balance vaporization loss. Best and Taylor[21] give the vaporization loss of a healthy average-sized man at light work in a temperate climate as 28 ounces.

2. The urine output desired for the next twenty-four hours. If the patient is seriously ill or septic or is suffering from severe biliary disease or impaired renal function, an output of 50 ounces is aimed for. If none of these disabilities exist, a urinary output of 35 ounces or more, with a specific gravity of 1·015 or higher and in the absence of glycosuria is aimed for. The higher the specific gravity of the urine passed, the lower the figure acceptable as a satisfactory minimum.

Daily Totals –

TIME	IN					OUT								BALANCE
	ORAL	TUBE	IV	RECTAL	½ DAY TOTAL	VOMIT	STOMACH TUBE	DRAIN TUBE	URINE	FAECES	SKIN		½-DAY TOTAL	
									Progressive Balances →					
Date						Highest Temperature for day →								
↓						No Vomiting To date.								↓
June						6 P.M. – hiller Abbott Tube passed.								
22nd	2	4			6	8	12		–		7		27	-21
23	50	11			61	4	60		36		30	98·4	130	-90
24	73				73		92		24		40	99·4	156	-173
25	106				106				12		40	101^2	52	-119
26	60				60				18		40	100	58	-117
	11 a.m. operation – ileo-Transverse Colostomy.					Pre-op → 2 →					15			
27	26	40	40		106	8	Post-op		–		35	100^4	60	-71
28	5	40	134		179		25		20	A.M. P.M.	35 20	100^5	100	+8
29			53		53		47		57		40	99	144	-83
30			103		103		40		39		30	98·4	109	-89
July 1.			60		60				66		30	98·6	96	-125
2			135		135		57		75		30	98·6	152	-142
	12		35		47		11		47		30	98·2	88	-183
3	Patient very well.					Suction stopped. M-A Tube removed								
4	101				101				38		30	98	68	-150
5	75				75				73		30	98	103	-178
6	89				89				64		30	99·4	94	-183
7	86				86				42		30	98·2	72	-169
8	28				28				30		30	98·4	60	-201
9	41				41				46		30	98·6	76	-236
10	80				80				40		30	98·4	70	-226

FIGURE I. Daily summary of fluid balance of H.R.

3. Loss by abnormal routes. The loss by abnormal routes is the third factor to be provided for, and this is taken to include loss by vomiting, loss of fluid aspirated through Miller-Abbott, Abbott-Rawson or similar tubes used in conservative alimentary decompression, fluid lost through fistulous tracks of any description—for example, enterostomy, colostomy, external biliary drainage and fæces in diarrhœa *et cetera*. This is provided for by ordering to be given during the next twenty-four hours normal saline solution in an amount equal to the total of the amounts lost by all of the above routes during the twenty-four hours which ended at the immediately preceding midnight, or one pint, whichever is the greater. (A minimum of one pint is given so that the small salt loss via vaporization and urine is provided for.)

For example, if for the twenty-four hours ended midnight, July 1, the chart indicated vomitus 24 ounces, stomach tube 76 ounces, then when the patient was visited on the morning of July 2, five pints of normal saline would be ordered to be given for the twenty-four hours ending midnight, July 2. There is a standing order in the wards to keep continuous intravenous therapy flowing after midnight, carrying on without interruption, with 5% glucose in water. This is allowed for in the surgeon's calculations during his morning visit. For example, when the patient is visited, say, at 10 a.m., the fluid chart may indicate that one pint of 5% glucose in water had been placed in the flask of the intravenous apparatus after midnight. In the calculation of the dose for the day this is allowed for, it being subtracted from the estimated dose of glucose in water regarded as necessary for the twenty-four hours ending midnight of that day. Thus five pints is a hypothetical calculated dose of saline solution, with three pints of 5% glucose in water, the dose necessary to provide for vaporized loss and urine output. A slip is written as follows: "5 pints of normal saline and 2 pints of 5% glucose in water to be given to midnight tonight (Thursday) in addition to that in the flask at this moment (10 a.m.) (time of visit)." The written slip is attached to the fluid balance chart and is replaced daily by the new calculation. Confusion in the minds of the nursing staff is apt to occur unless orders are thus specified. The vaporized loss and the desired urinary output are provided for throughout by 5% glucose in distilled water. The loss by abnormal routes is provided for by normal saline solution with or without the addition of glucose. The use of sodium lactate Ringer's solution in preference to normal saline solution is considered in two circumstances, namely, when sodium ion loss is greater than that of chlorine ion and when the urinary function is inadequate. A salt loss in which the loss of sodium ion greatly exceeds that of the chloride ion is uncommon, but occurs in markedly excessive biliary drainage, through an ileostomy, and in the stools in diarrhœa. The lower the balloon of a Miller-Abbott tube descends in the small bowel, the more the chemical composition of the fluid aspirated approaches that discharged through an ileostomy. Provided the urinary output is kept adequate, normal saline solution is satisfactory for salt replacement purposes, irrespective of whether the predominant loss is sodium ion or chloride ion, the kidney being able to make the necessary correction of the body fluid sodium and chlorine concentration. However, when uræmic acidosis with inadequate urinary output is superimposed on water and salt depletion, the administration of sodium chloride solution is dangerous in that its chloride ion concentration is greater in relation to the sodium ion than it is in the plasma, and therefore its administration in these cases may increase the acidosis beyond tolerable limits.[18] Therefore the administration of sodium that is not in combination with chlorine or the anions of the other strong acids is indicated. Such is provided in sodium lactate Ringer's solution, as recommended by Hartman. After administration the lactate radicle is oxidized, the sodium ion being set free. For general purposes, and especially under public hospital conditions, it is advisable not to depart from the solutions recommended. It simplifies calculation of the daily dosages and in most cases these solutions supply the requirements. Each is isotonic, the 5% glucose solution in water being satisfactory when water replacement is required, the glucose rendering the solution isotonic and at the same time supplying necessary nourishment and correcting ketosis.

Normal saline solution with or without added glucose adequately provides for salt as well as water replacement. Blalock[34] states that with the exception of the sodium and chloride ions all the other inorganic ingredients of plasma can be supplied by body metabolism even when food is not allowed, and

therefore solutions more complex than normal saline are unnecessary. In certain cases the amount of glucose given per day as 5% glucose in water may be regarded as inadequate; 10% glucose in water can then be used, provided the rate of administration does not exceed seven ounces per hour.

Group B.

Group B comprises those cases in which the patients, when first seen, are suffering from depletion of both water and salt—for example, intestinal obstruction in which vomiting has been considerable. The initial task is the calculation of the water and salt requirements for the first twenty-four hours:

1. Loss by vaporization likely to occur and, 2, the desired urinary output are calculated and provided for by 5% glucose in water, as in Group A. (Second and subsequent days.)

3. The correction of the salt and water depletion existing. It had originally been decided to calculate this according to Coller and Maddock's "clinical rule", but for reasons already stated, the calculations had to be made entirely according to clinical symptoms and signs. The following are taken to indicate a water depletion of at least 6% of the body weight: sunken facies, dry lips, tongue and mouth, with thick speech, dulled sensorium, soft eye balls (and depressed fontanelle in infants), dry, warm, inelastic, wrinkled skin, rapid, soft pulse, these being associated with a history of thirst, loss of weight and oliguria. An attempt is made to estimate from interrogation of the patient, his relatives and his family doctor the amount of abnormal loss by vomiting *et cetera* as well as the degree of diminution of fluid and salt intake. The above symptoms indicate the existence of both water and salt depletion, but not the relative degree of each.[13] The dose for the first twenty-four hours is therefore glucose and water, accurately calculated to provide for the anticipated vaporization and urine loss, *plus* a quantity of fluid, equal to 6% of the patient's body weight, to correct the existing dehydration. The difficulty is to determine the desirable composition of this latter fluid. Normal saline solution used alone would result in excessive salt administration in that the dehydration in this type of case (for example, high intestinal obstruction) is due to (*a*) abstention from a presumably normal diet in which the proportion of salt to water would probably be less than that of normal saline solution *plus* (*b*) loss as vomitus, the average salt composition of which is usually hypotonic.

The following procedure was eventually adopted. The vaporization and urine doses are given as 5% glucose in water, and the dehydration replacement as (*a*) normal saline solution in an amount equal to fluid lost by vaporization and urine combined, *plus* (*b*) 5% glucose in water to make up the balance of the 6% body weight. The actual order is one pint of saline solution and one pint of 5% glucose in water alternately until all the saline solution has been given, and thereafter 5% glucose in water until the grand total of all fluids for the day has been given. The calculation of the dose for the second and subsequent days is determined by reference to the fluid balance chart, the main guide being the quantity of urine passed considered in conjunction with its specific gravity and the presence or absence of glycosuria. The allowance for vaporization and urine is calculated as for the first day.

In regard to the salt depletion existing, saline solution is ordered in an amount equal to the loss by vomiting and other abnormal routes (for example, Miller-Abbott tube aspiration) in the preceding twenty-four hours or one pint, whichever is the greater. It is of interest to note that this procedure adopted for the first day after admission approximates to Coller's[10] latest recommendation.

Group C.

Water depletion exists, but there has been no abnormal salt depletion through vomiting *et cetera*. This might occur from voluntary or involuntary abstention from drinking. The initial calculation is the amount of water and salt that will be required for the next twenty-four hours. Symptoms and signs of dehydration do not become definite until a deficiency of body water equal to 6% of the body weight is present.[2] Therefore the water depletion existing will be corrected by the administration of a dose equal to 6% of the body weight—that is, of one ounce of 5% glucose in distilled water for each pound of body weight. This amount is also taken automatically to provide for the vaporization loss and desired urinary output for the next twenty-four hours. There is no appreciable salt depletion to be corrected, but provision has to be made for the small loss that will occur in the next twenty-four hours via vaporization and the urine. This is provided for by the administration of one pint of normal saline solution.

For the second and each subsequent day provision for vaporization loss and desired urinary output is made as in Group A, and, there being no loss by abnormal routes occurring, one pint of normal saline solution per day is allowed to compensate for the probable salt loss via vaporization and urine.

All Three Groups.

In all three groups, if fluid and salt by mouth are allowable, the amount taken by mouth in one day is deducted from the calculated amount of intravenous fluid for the subsequent day, it being assumed that during the subsequent day the patient will probably be able to take a similar quantity by mouth. The objective in all three groups is the establishment and maintenance of a slight positive fluid balance, and satisfactory correction of the water-salt depletion is indicated by: A, disappearance of the symptoms and signs of dehydration; B, the return of the daily urinary output to normal; C, the establishment of a positive fluid balance on the chart. Experience suggests that if the daily urinary output is 35 ounces or more, and the urine has a specific gravity of 1·015 or more in the absence of glycosuria, one need not worry about A and C. If the urinary details remain satisfactory I tend to ignore a mathematically negative fluid balance.

A decrease in the daily urinary output in spite of a satisfactory balance suggests renal failure or hypoproteinæmia.[6] A coincident low or falling specific gravity indicates the former. If the clinical features suggest the latter, as is shown by the fluid balance recorded in Figure II, one litre of pooled human serum is given intravenously, subsequent treatment depending on the therapeutic result. The probability would be confirmed by plasma protein estimation, provided such were considered in conjunction with other blood chemistry details.

THE COMPLICATIONS OF INTRAVENOUS THERAPY.

Of the special dangers associated with prolonged intravenous therapy three that merit special discussion are salt intoxication, glycosuria and a coincidental low plasma protein content.

Salt Intoxication.

Two types of salt intoxication are described, that resulting from administration of excessive quantities of saline solution and that resulting from an individual intolerance to small quantities of saline solution.

As to how often harmful salt and water retention occurs from excessive dosage alone in patients with normal plasma protein levels and normal renal

efficiency is not easy to determine from the literature examined. Frequently the statement is made that œdema has occurred following intravenous fluid administration in cases in which the plasma protein content was "normal" or "not down to the critical level of 5·3"; but the possibility that the "normal" figure was due to hæmoconcentration from dehydration—that is, that a latent hypoproteinæmia was actually present—cannot be excluded by further examination of the text or data provided. However, Giblin,[25] in reporting on a series of abdominal wounds in Alamein, states "at first the only solution available for use was a 5% glucose in normal saline solution, but with this, œdema due to chloride retention developed after a few days". All these patients, being front line soldiers, must be presumed to have had a normal plasma protein content and normal renal function at the time of injury. They were given an average of six pints for the first day and five daily thereafter, each having continuous gastric suction. Later, Giblin used both glucose in water and normal saline solution, and although he gave one pint per day of normal saline solution more than indicated by my methods, no patients developed œdema. To maintain the plasma protein level he gave, after the third day, one pint of wet serum daily. In the literature on water balance examples are quoted as indicating various effects of excess salt administration, in which between three and seven pints of normal saline solution have been given every day, frequently when salt loss by routes other than vaporization and urine has not existed. With the calculations recommended here, the amounts of saline solution are one and a half pints for the first day following operation and one pint daily in all other circumstances except when salt loss by abnormal routes requires replacement. In the absence of a low plasma protein content or of renal failure salt retention is therefore unlikely to occur. In neurosurgical cases, in which a state of slight dehydration is desirable, it may be thought advisable to modify these figures of one and a half pints and one pint respectively.

The existence of intolerance to small quantities of saline solution as an individual peculiarity, as described by Coller and others,[16] is open to question.

Inasmuch as the basis of the calculations herein suggested is that of Coller and Maddock's article of 1940,[2] and because Coller and others[16] have since 1944 departed from some of the views expressed in that article, it is necessary to comment on the article in which they have modified their original views.

In this they conclude:

A. That their "clinical rule" for estimating salt requirements according to the plasma chloride level is misleading and dangerous and should no longer be used.

B. That many individuals are incapable of tolerating relatively small excess of salt solution during the immediate post-operative period, that this "salt intolerance" is relatively frequent following general anæsthesia, and that isotonic saline solution should not be given during the day of operation and during the subsequent first two post-operative days. They infer that this salt intolerance is a peculiarity apart from the intolerance occurring from grossly excessive salt administration and that it is not due to an associated low plasma protein.

Conclusion A appears justified, but conclusion B merits examination.

In each of Coller's cases I have calculated according to the methods described herein and from the data given by Coller the daily dosage of glucose in water and normal saline solution. These figures have then been compared with the doses actually administered by Coller.

In Coller's Case I, at the end of the sixth post-operative day, the patient had been given five pints of saline solution and six and a half pints of glucose in water in excess of the amounts indicated by my calculations.

Coller's Cases II and III are described by him as illustrating the effects of "relatively small, acute chloride excess". The total quantities of normal saline solution given for the day of operation and the subsequent day are ten pints in Case II and eight and a half pints in Case III, whereas the amounts indicated according to the calculations used in this present article are two and a half pints of saline solution in each case.

Coller's Case IV, rather than illustrating a special intolerance to salt, as he suggests, appears from the data given to be a case of salt retention due to the administration of grossly excessive quantities of water and salt in a patient possibly suffering from hypoproteinæmia.

Coller's Case V, although described by him as "an extreme accumulation of fluid in serous cavities as a result of a relatively prolonged, though slightly excessive, administration of sodium chloride", appears to be an undisguised example of sustained grossly excessive administration of salt and water to a hypoproteinæmic patient.

I therefore feel that Coller's conception of what constitutes a relatively small excess of salt solution is incorrect and misleading, that the "salt intolerance" he describes merely amounts to the effects of gross overdosage occurring in the case of patients suffering from hypoproteinæmia or other conditions predisposing to harmful salt and water retention, and that no indication exists to depart from the methods suggested in this present article.

Glycosuria.

If the rate of administration of glucose-containing solutions exceeds that at which the patient can metabolize the sugar, glycosuria results, and this may increase the urine volume to such a degree as to retard correction of any existing dehydration.

It being suspected that at the usual rate of administration, glycosuria was occurring with solutions in which the glucose percentage was no higher than 5%, frequent urine tests were conducted in eight consecutive non-diabetic cases, it being found that, in the majority, glycosuria occurred during a considerable portion of the first forty-eight hours after severe abdominal operations. With improvement in the patient's general condition the glycosuria disappeared. Standard[13] states that glycosuria often occurs with administration of 5% glucose solution intravenously at rates of ten to twelve ounces per hour. Therefore a urinary output, satisfactory quantitatively, is not regarded as satisfactory clinically unless glycosuria is absent. If glycosuria is present a dehydrating polyuria has to be excluded.

Hypoproteinæmia.

The great danger of massive infusion is salt and water retention directly due to a low plasma protein concentration, and hospital records reveal many instances in which patients have died in a state of œdema following apparently satisfactory fluid and salt replacement. Their histories suggest that unsuspected hypoproteinæmia may have been responsible.

"Too much emphasis has been placed on the water-electrolyte requirements of the surgical patient and too little emphasis on the mechanisms involved in keeping fluid in the blood vessels" (Blalock).

The total amount of body water is proportional to the total body electrolyte content, but the relative distribution of this body water between the intercellular spaces and the plasma is governed to a large degree by the

concentration of the plasma proteins. The lower the concentration, the greater the tendency to excessive accumulation of water in the tissue spaces. If the concentration falls sufficiently low, and sufficient fluid is available, œdema results. Many surgical patients have a low total plasma protein content when first seen. If the patient is normally hydrated, the concentration in the plasma will be low and therefore the clinical features of hypoproteinæmia will be present. If, however, as is very frequently the case, the patient is also dehydrated, the plasma concentration may be normal. If the dehydration is corrected, the concentration of the plasma protein falls, with the development of the clinical features of hypoproteinæmia. The administration of even small amounts of fluid to such a patient can cause pulmonary œdema long before a positive water balance is attained. The cause is not that fluid has been given in too great a quantity or too rapidly, and the cure is not necessarily cessation of fluid administration. The treatment is administration of protein. At present, in our practice, hypoproteinæmia requiring urgent relief is treated with pooled human serum given by the intravenous route until more adequate replacement can be instituted.

The main clinical effects of hypoproteinæmia are as follows.

A. Circulatory failure, which may take the form of ordinary acute surgical shock or the less acute circulatory failure seen in post-operative shock, intestinal obstruction and general peritonitis. It is not suggested that circulatory failure occurring in patients undergoing fluid replacement is always or entirely due to hypoproteinæmia, but that the latter is often a factor appears to be without question.

B. Peripheral œdema. Although peripheral œdema is the most obvious and suggestive sign, it must be regarded as a late manifestation. Diminution of the urinary output, in spite of an improving water balance, suggests its imminence. It has been suggested[6] that, excluding instances of definite renal impairment, most cases of post-operative diminution of urine are due to aggravation by plasma loss at the site of operative trauma of a previously existing, unsuspected hypoproteinæmia (often of nutritional origin). An early sign of œdema may be indefinite firmness of the lateral abdominal wall with the appearance of creases from bedclothes pressure, which tend to persist. It may first become obvious in the extremity in which the intravenous fluid is being administered and may erroneously be regarded as due to phlebitis.

C. Visceral œdema, which may manifest itself as ascites, pleural effusion or pulmonary œdema. Œdema of the alimentary tract may be of such degree as to be entirely responsible for obstruction at an anastomotic stoma.[4]

D. Inhibition of gastro-intestinal motility. Failure of a Miller-Abbott tube to pass at a satisfactory rate may be due to this factor and, if so, its correction is aided by the intravenous administration of plasma. A well-developed ileus may be due to this factor alone and may be cured in a similar manner.[7][4][28] Deficiency of vitamin *B* complex increases the inhibition.[5]

E. The retardation of wound healing, the effect being increased by vitamin *C* deficiency.[5] It may result in slow healing of abdominal incisions, burst abdomen, leakage of anastomotic suture lines and failure of skin grafts.

Protein starvation commences as soon as excessive loss of intestinal contents by vomiting or aspiration via Miller-Abbott or similar tubes is established. Lowering of the total plasma protein content rapidly results,[28] and as body protein reserves are normally slight, such fall persists. Therefore, the patient whose illness is such as to warrant planned fluid-electrolyte administration is also liable to be suffering from a lowered plasma protein content.

Two factors tend to mask the presence of a lowered total plasma protein content. The first is dehydration, this causing a normal plasma protein concentration or preventing the most obvious sign, namely, œdema, from appearing. The second is a rise in the plasma globulin content (from infection or other causes) coincident with a fall in the plasma albumin content, so keeping the protein concentration normal, but with a lowered osmotic pressure value (this being mainly provided by plasma albumin).

There is no doubt that planned pre-operative correction of hypoproteinæmia, which is often symptomless and present more often than one might expect, and post-operative provision of protein by means other than, or in addition to, the usual dietetic methods, will considerably alter present post-operative mortality figures.

The following case history illustrates many features of mismanagement of fluid balance therapy. Excessive positive fluid balance and hypoproteinæmia with most of the signs and symptoms described, including diminished gastro-intestinal motility, were present. It also illustrates most dramatically the effect of protein administration to a hypoproteinæmic patient.

CASE II.—Mrs. D.C., aged forty-two years, had a hysterectomy for a fibroid uterus. On the first post-operative day the temperature was 99·6° F. and the pulse rate 100 in the minute. There was no vomiting. On the second day, in the late evening, the patient complained of nausea, flatulence and abdominal pain. During the night she vomited fairly frequently, and in the early morning of the third day the pulse was irregular and of poor volume. Examination revealed moderate upper abdominal distension, a pulse rate of 140 per minute and obvious dehydration. Duodenal aspiration and the intravenous administration of saline solution were commenced an hour later, the pulse being 160 and the patient almost moribund. On the fourth, fifth and sixth days the patient appeared improved, but the daily quantities of vomitus and aspirated fluid were increasing. One enema gave a fair fæcal result but no flatus. On the seventh day the patient's condition was worse. The vomitus amounted to ten ounces. Aspirated fluid amounted to 333 ounces, but was odourless. The urine passed was 59 ounces. On the eighth day the patient's condition was worse. There was no vomiting. Aspirated fluid amounted to 272 ounces and was now fæculent. The urine measured 59 ounces. In error, both aspiration and intravenous administration of fluid were stopped during the night.

On the ninth day the vomitus amounted to seven ounces and aspirated fluid to 164 ounces. The amount of urine dropped to nine ounces and progressive fluid balance was −5 ounces. Both intravenous therapy and duodenal aspiration were resumed. On the tenth day, at 1 p.m., the patient complained of flatulence and abdominal pain. At 2.30 p.m. she vomited the duodenal tube. At 6 p.m. she was given tea and toast. Shortly afterwards the pain recurred, her abdomen became distended and operation was considered. For the day vomitus amounted to seven ounces; the aspirated fluid amounted to 48 ounces and was less offensive. The urine measured 71 ounces.

On the eleventh day, during the night, her condition became worse and the abdomen more distended, and from 4 a.m. the vomiting was fæcal and most offensive. At 9.30 a.m. the duodenal tube was reinserted. Redness, tenderness and œdema had appeared in the right leg following some days of intravenous therapy. Fluid had been continuously administered intravenously since the third day. For the day, vomitus amounted to 25 ounces, aspirated fluid to 172 ounces and urine to 39 ounces.

On the twelfth day similar œdema was present in the right arm, which had also been used for intravenous therapy. The right leg was more œdematous. Her temperature was 100° F. The abdomen was still distended. At 1 p.m. the patient was given fish, vegetable and custard in error. At 2.30 p.m. she complained of severe abdominal pain. At 3.15 p.m. the tube was vomited and reinserted. For the day the vomitus totalled 16 ounces, aspirated fluid 132 ounces, and urine 37 ounces. At this stage she was suffering from excessive fluid administration *plus* hypoproteinæmia. She had peripheral œdema, but it was most marked in areas in which it was thought to be explained by a phlebitis from the therapy, the rise in temperature being taken as confirmatory.

On the thirteenth day the abdomen was still distended, with some abdominal pain at times. To this stage aspiration had been carried out with a duodenal tube. This was now replaced by a Miller-Abbott tube. The left leg had been recently used for intravenous therapy and had now become swollen and painful. The temperature was now 102·2° F. For the day vomitus amounted to 28 ounces and aspirated fluid to 172 ounces. The urine output was falling, being 25 ounces.

On the fourteenth day the Miller-Abbott tube was passing steadily but slowly, the aspirated fluid being fæculent and the abdomen much less distended. The decompression appeared to be acting satisfactorily, but the œdema was more marked. At 6.30 a.m. the temperature was 101° F. and the pulse rate 148 per minute. At 1.20 p.m. the patient complained of feeling cold and shivery; she looked anxious and ill and was given brandy. She suddenly became unconscious, restless, pale and clammy, but without marked perspiration; the respirations were shallow and irregular, the pulse almost imperceptible. She was given stimulants, but appeared to be dying. However, she improved. At midnight on this day her urinary output was nine ounces, as compared with 25 ounces on the thirteenth day and 37 ounces on the twelfth.

Most of the features of hypoproteinæmia were now present, namely:

1. Circulatory failure.

2. Peripheral œdema.

3. Visceral œdema. A contributory factor to the obstruction and a reason why the passage of the Miller-Abbott tube was so slow was apparently œdema of the bowel wall, both generally and at the site of obstruction. This was associated with:

4. Inhibition of gastro-intestinal motility, possibly increased by vitamin *B* complex deficiency. Biochemical confirmation of a lowered plasma protein level was not available. Pooled human serum to be given intravenously and vitamins to be given by

Post-operative day. Progressive Balance

TIME	IN						OUT								BALANCE
	ORAL	TUBE	I.V.	RECTAL		½ DAY TOTAL	VOMIT	STOMACH TUBE	DRAIN TUBE	URINE	FÆCES	SKIN	↓	½ DAY TOTAL	
3rd	48	—	100			148	30	32		23		40	+23	125	+23
4th	57	20	70			147	39	76		19		40	−4	174	−27
5th	109	40	85	12		237	57	85		26	12+	40	+13	220	+17
6th	129	35	125			289	61	182		34		40	−20	317	−33
7th	229	52	175			454	10	333		58		40	−7	441	+13
8th	191	68	110	12		373	—	272		59	12	40	−5	371	+2
9th	137	74	90			301	7	164		9		40	+76	220	+81
10th	68	22	190	12		292	7	48		71	12	40	+190	178	+114
11th	113	14	185			312	25	172		39		40	+226	276	+36
12th	156	36	100	24		316	16	132		37	24	40	+283	249	+67
13th	175	28	75			278	28	172		25		40	+301	270	+8
14th	162	53	50	17		282	80	187		9		40	+265	318	−36
15th	70	71	30	SERUM		171	6	164		122		40	+108	332	−161
16th	71	38	30			139	4	39		55		40	+105	138	+1
17th	78					78				65		40	+79	105	−27
18th	96					96				60		40	+74	100	−4
19th	112					112				70		40	+76	110	+2

FIGURE II. Daily summary of fluid balance of Mrs. D.C., showing one use of an untitled column.

injection were ordered, and the administration of salt and water was stopped. At 7 p.m. blood transfusion was commenced, and at 8 p.m. pooled human serum was added to the flask. At midnight she had had eleven ounces of blood and six of serum.

On the fifteenth day the patient's condition was much improved, the abdominal distension was less, and the Miller-Abbott tube had passed further. At midday the urine output was 50 ounces and at midnight 122 ounces for the day. The vomitus totalled six ounces compared with 80 on the previous day. Aspirated fluid was 164 ounces. The patient had 30 ounces of pooled serum for the day.

On the sixteenth day the œdema at all sites was less. The Miller-Abbott tube had passed for a distance of four feet, and the aspirated fluid was clearer and had lost the fæculent odour. The abdomen was flat and soft. In succession, flatus was passed *per rectum*, the bowels were open spontaneously for the first time, a fair amount of soft yellow stool being passed, the balloon of the Miller-Abbott tube was allowed to collapse, and intravenous therapy was discontinued. At midnight she had had 30 ounces of serum and had vomited four ounces. The aspirated fluid was only 39 ounces. The amount of urine was 55 ounces.

On the seventeenth day no drainage occurred from the Miller-Abbott tube and there was no vomiting. The urine measured 65 ounces. From now on recovery was rapid, the diet being gradually increased and vitamins being given orally. On the twenty-third day the Miller-Abbott tube was withdrawn. She never again experienced

abdominal discomfort while in hospital. Three years later she was well, having had no symptoms suggestive of obstruction in the interim.

Figure II shows the daily totals of all intake and output for the period during which the charts were kept. On one day nearly 17 pints of fluid were aspirated from the alimentary tract; it consisted of intestinal secretion, fluid taken orally and fluid used for washing through the indwelling tube.

This indication of the large quantities that may be involved illustrates the necessity for accurate charting. Also to be noted are: the steady fall in urinary output from the tenth to the fourteenth days inclusive, associated with the excessive positive balance and the development of the clinical features of hypoproteinæmia; the sudden increase of urinary output from the fifteenth day onward and associated with the administration of serum intravenously; and the fall in quantity of vomitus per day and the amount of fluid aspirated from the intestines from the fourteenth day onward.

Many errors occurred in the management of this case. A Miller-Abbott tube should have been used at a much earlier stage. The development of a grossly excessive positive balance from the tenth day onward was ignored. This could not have happened if a progressive as well as a daily balance had been recorded. The assumption that the œdema most marked and at first only apparent in the limbs used for intravenous therapy was entirely due to phlebitis was incorrect.

The intestinal obstruction was regarded as being due to recent plastic adhesions, and it was thought that if the patient could be given time (with the aid of alimentary suction and replacement therapy) subsidence of inflammatory congestion and the natural tendency for recent adhesions to absorb might be sufficient to allow reestablishment of an adequate passage of intestinal contents.

It was thought, in retrospect, that other factors contributing to the obstruction were diminished intestinal motility from lack of vitamin *B* complex and the presence of œdema of the bowel generally, and œdema at the primary site of obstruction contributing to the mechanical block. The administration of the protein apparently resulted in relief of this œdema and decreased motility of the bowel, as evidenced by the acceleration of the passage of the Miller-Abbott tube and the rapid relief of the obstruction.

THE CHARTING OF THE FLUID BALANCE.

Accurate daily records of the character and quantity of fluids administered, the amount and nature of fluid loss, and the calculation of the daily balance are essential for proper establishment and maintenance of fluid-electrolyte balance.

Of the charts I have examined, most suffer from the defect that they are too complicated, the result of attempting to include all possible data. It has to be realized that the actual hour by hour entering of the data must necessarily be done by the nursing staff, different columns often being the responsibility of different nurses. For example, the most junior nurse usually is responsible for bed pans and urinals, and therefore for the urine column. The chart should therefore be designed so that it will give the maximum information consistent with the simplicity necessary to allow of its management by a number of nurses of varying degrees of intelligence and seniority.

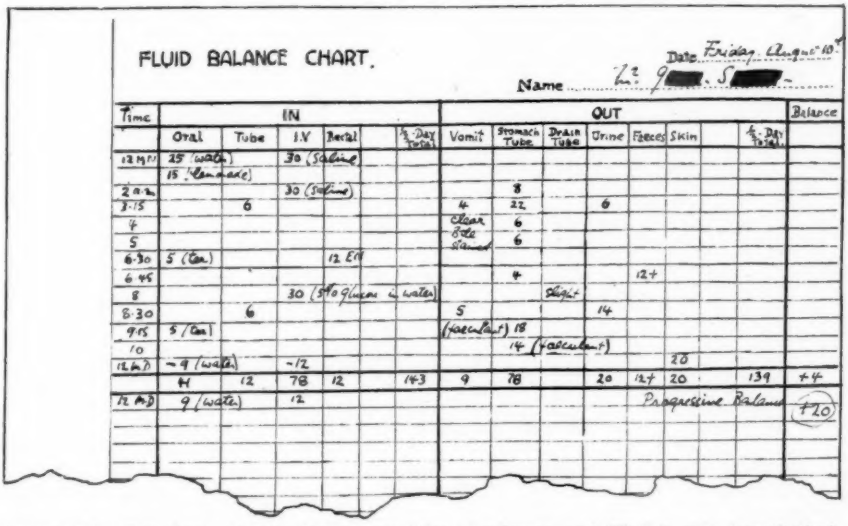
With such a chart as a basis, more complicated charts showing special data can be constructed by the surgeon or house surgeon if so desired. Standard,[18] Hamilton Bailey,[20] and Wangensteen[21] illustrate charts which show only the daily totals and which must be compiled from data recorded elsewhere.

Christopher[10] illustrates a chart devoted solely to recording the details of Wangensteen suction. Pfeiffer, in taking part in a discussion on parenteral

fluid administration,[17] presents the chart used at the Abington Memorial Hospital, United States of America, which records daily totals only. In discussing his experiences in evolving a chart he states:

> We tried at first a special chart on which the intake and output of water . . . etc. were consolidated. The nurses made mistakes in addition and collection in spite of all we could do. Another matter was the education of the younger men, the resident and intern. While we were so keen on the matter and discussing it all the time and talking about it in our meetings, everyone was "salt and water conscious", but when we could no longer afford to dwell so much upon the matter, the successive generations came along without adequate instructions in the fundamentals. We found that we could not turn these things over to our younger men. So it became a very great burden to the permanent staff to see that these matters of salt and water balance were properly adjusted.

In 1941 I set out to design a chart which, while giving adequate information, could be managed by the average nursing staff of a training hospital. It was felt desirable that entries should be made as the necessity arose, and



FLUID BALANCE CHART.

Name [redacted] Date Friday August 10th

Time	IN						OUT							Balance
	Oral	Tube	I.V.	Rectal		24 Hour Total	Vomit	Stomach Tube	Drain Tube	Urine	Faeces	Skin	24 Hour Total	
12 M/N	25 (water)		30 (Saline)											
	15 (Lemonade)													
2 a.m.			30 (Saline)					8						
3.15		6					4	22		6				
4							Clear Bile Stained	6						
5								6						
6.30	5 (Tea)			12 E/N										
6.45								4			12+			
8			30 (5% Glucose & water)						Slight					
8.30		6					5			14				
9.15	5 (Tea)						(faeculent)	18						
10								14 (faeculent)						
12 M/N	-9 (water)		-12									20		
	11	12	78	12		143	9	78		20	12+	20	139	+4
12 M/D	9 (water)		12								Progressive Balance			+20

FIGURE III. The chart, showing layout and titles of columns, and filled in with hypothetical data to serve as a sample chart to be posted in wards in conjunction with "Directions for Entering" sheet.

by the person managing the particular incident. For example, if a junior nurse emptied a urinal she should measure the amount, have the authority to enter it and the time on the chart without reference to a senior, and possess the knowledge as to how to measure and record in a uniform manner all modes of intake and output. The chart finally developed is shown in Figure III. It is printed on paper identical in size with the standard identification and history sheets used in Victorian public hospitals and is tinted pink to allow ready selection from the green identification and white history sheets. The number of columns, their width and their titles were determined after much trial and error in the wards of the Geelong Hospital, and my thanks are due to the Medical Superintendent, Dr. O. Burger, for his cooperation and suggestions during this period. A sheet of instructions to nurses for entering the chart was devised and, with a sample chart filled in for a hypothetical case (Figure III), was posted in each ward. These

instruction sheets were modified many times and that now recommended has proved satisfactory. The instruction sheet reads as follows:

FLUID BALANCE CHART.

DIRECTIONS FOR ENTERING.

All nurses are to make themselves familiar with these instructions and to adhere to them exactly.

All quantities are to be entered in ounces in Arabic (*e.g.*, 2), not Roman numerals (*e.g.*, ii). The figure only is to be charted, *i.e.*, the letters "ozs" are not to be written in.

Fractions of an ounce are not to be entered.

A separate sheet is to be used for each 24-hour period, commencing at midnight (or time of admission). At midnight and at midday two lines are to be ruled across sheet (see sample) and the totals for each column to be added and entered.

Date.—Both date and *day* of week to be written in.

Oral, Tube and IV.

In the case of these columns, enter on the chart the amount *started with.*

In the case of "oral", start where possible with a full lemonade bottle (this holding 25 ounces), the bottle being left on the locker.

In the case of "tube", use a pint measure instead of a lemonade bottle, the measure being left on the locker. A measure is used whether the fluid is used for nourishment, for washing through an indwelling tube or for washing out the stomach.

In the case of "IV" the amount put in flask is entered on the chart as soon as it is put in.

In all three columns, at midday or midnight, the amount left in the container (bottle, pint measure or flask) is entered in the appropriate columns in *red ink* with a minus sign in front, and subtracted from the total.

Just below the 12-hour total the same amount is entered in ordinary ink so that it will be included in the next 12-hour intake,[1] *e.g.*:

10 a.m.	25 (milk)		30 (saline solution)
11 a.m.		20 (water)	
	−6	*−15*	*−8*
12 midday	19	5	22
12.5 p.m.	6	15	8

[1] Instead of red ink, italics have been used in the reproduction.

Oral.—Includes drinks, saline, fluid foods such as Benger's, etc.

Tube.—Includes stomach tube, Miller-Abbott tube, Abbott-Rawson tube, gastrostomy tube, enterostomy tube, etc.

IV.—Includes intravenous, subcutaneous, intraperitoneal, saline, glucose in water, serum or blood. The strength and composition is to be entered in brackets, *e.g.*, "23 (saline)". The amount *put in flask* is to be entered as soon as put in. If the total quantity is not used when the totals are compiled, the amount left in flask is to be entered in same column in *red ink*, with a minus sign in front, and the same amount entered in the following 12-hour period in the usual way.

Rectal.—Includes total amount *run in* of rectal saline or *enema.*

Fæces.—Estimate roughly. Includes enema or saline *return.*

Vomit. Stomach Tube.—Indicate important constituents, *e.g.*, "16 (coffee grounds)", "18 (fæculent)".

Drain Tube.—If connected to receptacle, measure quantity in ounces. If draining into dressing, estimate and write in as "slight", "moderate" or "profuse" at time dressing is changed.

Urine.—The specific gravity and the presence or absence of sugar and albumin are to be entered in brackets alongside every entry in this column.

Skin.—To be estimated by the house surgeon.

Half-Day Totals and Balance.—To be entered by the house surgeon.

A few comments on the above instruction sheet are necessary. There was discussion for some time whether it was desirable to make the half-day totals

at 6 p.m. and 6 a.m.—that is, at the time of change-over of day and night staffs. This was found to cause confusion in regard to the date at the top of the chart, and it is now found that totals at midnight and midday are the most suitable. A surgeon should not be allowed to choose his own times, as this makes for confusion if different surgeons choose different times. It is desirable for the day as well as the date to be filled in, as the surgeon often thinks in terms of "what happened on Tuesday" rather than in terms of dates.

The column headed "IV"—that is, intravenous—is used to include methods of administration not provided for by the other columns. Although from the standpoint of calculation of amounts given the amount used in an enema is of little practical importance, the nurses are asked to enter the figure so that the necessity for entering all intake and output is impressed upon them. In a desire for scientific accuracy considerable thought was given to instructions for measuring the fluid volume of fæces; but it was realized that in the average surgical case this was of little practical importance, and to insist on accuracy was to introduce confusion in the minds of the junior trainee nurses whose responsibility this would probably be. The position is entirely different when a patient has diarrhœa. Similar difficulty arose in respect to volume of drainage in the column "Drain Tube", and it was decided that the instructions given were adequate for practical purposes. If the surgeon attempts to divert all drainage into receptacles, as some American surgeons insist is necessary, the nurse's problem is simplified. The column "Skin" is taken as indicating vaporized loss and is estimated and entered up at each half-day addition by the surgeon or house surgeon according to the principles already indicated. Two columns without title are present to allow for any special feature of the particular case (Figure II).

It is desirable not to use one sheet for more than one day and to keep the fluid balance sheets séparate from the history sheets while the patient is having his fluid balance regulated. This simplifies the nurse's task of entering the data. It is our practice to clip these to a sheet of cardboard from an X-ray film box, one file to each patient. It is desirable to keep a progressive balance at each half-day period. This prevents an unsuspected gradual and excessive creeping up of a positive balance.

A surprising feature was the number of charts we eventually found we were using per day. My present practice is to record the data of all very ill and all potentially ill patients on these charts from the time of operation. Usually within a few days the necessity for accurate charting disappears. It was interesting to find how erroneous one's impression of fluid intake and balance was without the keeping of a chart. Time and again it was found that in spite of only the usual post-operative vomiting and the sister's comment that "the patient is taking fluid well", the calculated balance was seriously on the negative side. Of course, all patients with abnormal fluid loss or any suggestion of dehydration on admission are immediately placed on these charts and the charting is continued without interruption into the post-operative period.

There are two suggestions we have not as yet adopted. The first is the use of a metal disc painted a bright, distinctive colour and with the words "Fluid Chart" painted on it, such a disc to be clipped onto the bed of all patients with fluid balance charts. This would eliminate the failure of fluids to be measured because the nurse "did not know the patient was on a chart". Occasionally a patient will call a passing nurse, not normally nursing the patient, to take a urinal or bring a glass of water. The disc would immediately indicate the position.

The second suggestion is the use of a special metabolic or fluid chart nurse, whose sole duties would be the supervision and training of the nurses

dealing with all fluid chart cases in the hospital, and the preparation, distribution and charting of all fluids administered orally. The use of such a nurse is noted by Pfeiffer.[17] Manpower difficulties have as yet prevented the creation of such a position in our hospital.

In conclusion, the paucity of references to biochemical investigations in this paper is due to wartime lack of facilities for their collection. When biochemical confirmation of clinical impressions becomes available it will be used, but with two provisos: one, that the major reliance will be placed on clinical impressions, and two, that no investigation will be considered without reference to investigation of other related biochemical factors.

SUMMARY.

1. Practical details of the day-by-day calculation of the optimal dosage of water and salt for each of three groups of surgical cases are given. Surgical cases requiring calculated fluid balance fall into one of three groups:

Group A.—Cases in which there is a satisfactory water and salt balance but in which excessive loss is expected to occur from post-operative vomiting or continuous alimentary aspiration, as in the early post-operative period of severe abdominal procedures, such as gastrectomy.

Group B.—Cases in which the patient, when first seen, is suffering from depletion of both water and salt—for example, in high intestinal obstruction.

Group C.—Cases in which the patient, when first seen, is suffering from lack of water but not salt—for example, insufficient water intake has occurred from either voluntary abstention or inability to swallow.

The clinical indications of successful establishment of water and salt balance are enumerated.

2. Of the many complications that may be associated with intravenous therapy, three are discussed, namely, salt intoxication, glycosuria and hypoproteinæmia.

The importance of hypoproteinæmia as a common cause of œdema appearing during continuous intravenous therapy is indicated.

The common manifestations of hypoproteinæmia are described and references to literature describing this condition in all its aspects are given.

A description is given of a case of post-operative intestinal obstruction illustrating excessive fluid and salt administration and exhibiting the clinical features of hypoproteinæmia. The dramatic response to protein administration in the form of pooled human serum is described.

3. A fluid balance chart, uniform in size with standard hospital charts, originated at the Geelong Kitchener Memorial Hospital and adopted by the Royal Melbourne Hospital, is described.

It is designed to give the maximum information consistent with the simplicity necessary to allow of its management by a number of nurses of varying degrees of intelligence and seniority.

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THE MILLER-ABBOTT TUBE IN THE TREATMENT OF ILEUS.[1]

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THE aim of this paper is to record certain difficulties, failures and successes in the use of the Miller-Abbott tube, and is primarily a record of personal experience rather than a review of the subject.

The use of the term "ileus" is open to criticism; but we know what is meant, which is the most important thing. It means small bowel obstruction of neuro-muscular origin, a condition not due to mechanical block of the bowel lumen. The lesion is a nervous one, sometimes central but mostly local. The muscle has not lost its power of contraction, as shown by the rapidity with which a tube can be passed along the small bowel. In the experience of most general surgeons the commonest immediate causes are: (*a*) Peritonitis. (*b*) Trauma of the bowel and mesentery consequent upon a mechanical obstruction which has been relieved by operation. The latter often plays a large part in inflicting injury. (*c*) Lesions of the posterior abdominal wall or its contents. (*d*) Extraabdominal causes, such as pneumonia and plaster jackets.

Death is due to a combination of salt loss, water loss, toxæmia, starvation, pneumonia.

The aim of treatment is to keep the patient alive until the inhibitory influence on bowel function is gone.

REASONS FOR USE OF THE TUBE.

The Miller-Abbott tube in the treatment of ileus can be used for: (*a*) gastric suction, (*b*) emptying the distended small bowel with restoration of its function, (*c*) localization of the site of obstruction.

Gastric Suction.—Before Miller-Abbott tubes were invented, patients recovered from ileus. In the past few years we have all had experience of the treatment of wounds of the abdomen in which gastric suction, together with intravenous administration of fluids, chemotherapy and morphine, secured many favourable results. The embarrassment of respiration due to a distended stomach and the danger of pulmonary infection from copious vomiting by a weakened patient can be removed by any simple form of tube. One should remember, then, that during the period, short or long, which may precede the entry of the Miller-Abbott tube into the duodenum, this very desirable form of treatment has been going on.

Emptying the Distended Small Bowel.—In few cases is intubation of the small bowel really necessary. Ileus is a common condition, but in most cases it is transient, lasting two or three days, and with experience it is possible to foretell its approximate duration. In the last two years I have helped in the treatment of ten patients when intestinal intubation was highly desirable. I cannot give the number of those who needed gastric suction for only a day or two, but they are several times as numerous as the former group. Of these ten, efforts to intubate the small bowel ended in failure in four instances. Of the three patients who died, one had been operated on for

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a bullet wound of the sigmoid colon and died on the eighth day from pneumonia, almost certainly due to lack of care on my part in the intravenous administration of fluids. The second death was that of a soldier admitted to hospital recently after having had a mechanical intestinal obstruction due to a band for eight days. Efforts to introduce the tube into the small intestine failed because in his delirium the tube was pulled out several times. The third patient, a middle-aged man, died from pneumonia on the tenth day of his illness. No cause of the ileus was found after death, although at operation a foot of terminal ileum had been red and œdematous. All efforts to pass the tube into the duodenum had failed.

Of the six patients in whom successful intubation was carried out, one boy, aged twelve, died from suppurative pylephlebitis after an illness of weeks. I am as certain as experience can make me that the remaining five would have died if intestinal intubation had not been performed.

Removal of the fluid and gas, mostly swallowed air, results in the immediate restoration of both motor and digestive bowel function. Not only is the tube passed on rapidly, but each loop through which the tube is passed is capable of absorbing fluid, of secreting enzymes and absorbing the products of digestion. For this reason all intravenous therapy may be stopped as soon as a loop or two of the jejunum has been aspirated. This is a great relief to patient, nursing staff and surgeon, for there is often no more worry about drowning or dehydrating the patient, no difficulty in administering proteins and vitamins, and no more thrombosis of veins or blockage of cannulæ. The improvement in the condition of the patient is very rapid. The diet is at first "milk and milk foods" with the protein content kept high and the residue low. By the time the tube has approached the ileo-caecal junction a very liberal diet can be given.

Localization of the Site of Obstruction.—Mechanical obstruction, usually partial or intermittent at first, frequently follows ileus due to peritonitis. It has been possible in two such cases to show accurately by X-ray examination the actual loop or loops involved. When the occasion arises barium can be injected down the tube to investigate the state of patency of distal loops.

MANAGEMENT OF THE TUBE.

With care and patience the tube can be passed into the small bowel, in two cases out of every three in which it is really essential to do so. I shall describe my experience in introducing the tube, without any reference to the various suggestions found in the literature. The tube should be used early for three reasons. Even though not apparent at first, intestinal intubation may later become necessary. Secondly, it is bad to be behind at the commencement of the contest to maintain fluid balance. The tube is often not used until vomiting commences, when a sudden loss of several pints may occur. Early distension, especially of the epigastrium, is a sufficient indication for intubation and intravenous administration. Thirdly, the more the stomach is compressed against the diaphragm, the harder it is to make the tube point towards the pylorus. The first and essential step is to test the bag, making certain it does not leak. Blow it up and dip it into a bowl of water. The end of the tube and deflated bag are then smeared with paraffin and passed along one nasal cavity until the patient feels the tip entering the naso-pharynx. He is then instructed to fill his mouth with water and told to swallow small amounts. As he swallows, the tube is passed into the œsophagus and can usually then be introduced into the stomach without difficulty.

The tube is pushed in until the 65 mark is at the nostril. Suction is then commenced and maintained constantly, the patient is given absolutely nothing by mouth and is propped up in bed and well over to his right side. The

cardiac end of the stomach is posterior as well as cranial to the pyloric antrum and the tip of the tube likes nothing better than to flop into it.

Failures in passing the tube into the duodenum are mainly due to too much haste. For the most part Miller-Abbott tubes can be passed only by surgeons resident in the hospital. It takes hours of patient waiting and many visits and manipulations. When the stomach is becoming empty, as evidenced by a lessening in the amount of fluid being sucked up, take an X-ray picture. I have used the screen on two occasions only, and only once in the case of a really sick man, but some time may be saved by this method.

Distension of the small intestine pushes the stomach against the diaphragm. This angulates the lesser curvature, so that it is difficult to make the tube follow the *Magenstrasse* round to the pylorus. If the tip persists in pointing to the left in spite of several hours of posturing on the right side, the tube is passed on to the 75 mark, which enables it to make one turn in the stomach and point to the pylorus. Under the screen I have noticed how the pyloric antrum remains closed, so that often the tube is forced to make a second turn into the fundus. I know of no manœuvre to prevent this, although the drinking of small quantities of ice-cold water has probably helped on occasions. If the tube has not turned towards the pylorus, there is nothing to do but keep the patient on his right side with the stomach empty. A tube with a heavy tip—for example, one filled with mercury—is needed to bring the tip rapidly to the pylorus. We have made some encouraging experiments with such a tube.

When the tube points to the pylorus the battle is half over. Another three inches of tube are threaded through the nose, posture and suction are maintained, and another X-ray picture is taken, not earlier than six hours afterwards. For example, if a patient first has the tube introduced at midday, I do not expect the tip to be in the duodenum until during the night and do not endeavour to confirm this until early morning. With experience one can tell with a fair degree of certainty where the tip of the tube is, from the nature of the fluid aspirated, but it is better not to rely on this.

It is axiomatic that the tube is not used to try to cure mechanical bowel block. The selection of suitable cases is diagnostically easy, and the use of the tube may be happily combined with operation. In these cases no time should be wasted in trying to get the tube into the duodenum before operation. Its onward progress into the duodenum is left until afterwards. I have had no success in passing the tube at the time of operation. The incision is usually too far away.

Once the tip of the tube is well into the duodenum, but not until then, the bag is blown up, suction is maintained and a further six inches of tube are introduced every hour. In three hours the tip should be in the first loop of the jejunum, after which an X-ray examination is not necessary for twenty-four hours and after that only for some special purpose. We use condoms for substitute bags. Thirty cubic centimetres of air are used to fill the bag. The tip is allowed to pass to, or through, the obstructed part of the intestine. When it is considered that the ileus is gone, the bag is deflated and the suction stopped, but can be recommenced should distension recur. All the time care should be taken that the holes in the tube do not become blocked. When it is clear by trial that the bowel is working well along its entire length, the tube is allowed to stay in position without suction and with bag deflated for a further two or three days and then withdrawn, so that the tip lies only half-way down the jejunum. All being well, the tube can be completely removed the following day, the patient being allowed to do this himself.

Prostigmine, ergotamine tartrate, pituitrin and other substances have been suggested to restore bowel function. I have not found them necessary and

thus cannot comment on their use. The bowels will not work until the cause of the ileus has disappeared and should not be stimulated until then. They usually work of their own accord, although small enemata are sometimes required.

Hazards and Difficulties.

One surgeon only should manage the introduction of the tube in each case, otherwise confusion of plan and ultimate failure are the inevitable result. A busy consulting surgeon cannot manage these patients efficiently. Care should be taken to prevent injury of the nose and throat.

Knowledge of the direction in which the tube is pointing is essential in the early stages. No tube should be advanced further through the nose unless the tube is pointing to the pylorus. It is possible for the pylorus to allow one or more loops to enter the duodenum while the tip remains in the stomach. Excess tubing in the stomach while the tip is there may also result in knotting of the tube. I have seen both these misadventures.

A deflated bag will not go down the jejunum. The first stages of the tube's progress after it has entered the jejunum should be checked. A leaking bag in one of my cases stopped at the duodeno-jejunal junction while two loops were passed through the pylorus during the night. The ward sister, quite naturally, thought that the tube was going down the small intestine. If the tube after entering the stomach will not point towards the pylorus, it should be withdrawn to the œsophagus and allowed to enter the stomach again. Changes of posture should be tried, or, if the condition of the patient warrants it, the passage of the tube towards the pylorus should be attempted under the screen. If all manœuvres fail, one must be content with gastric suction. Sometimes the tube will enter the duodenum of its own accord after all efforts of the surgeon have failed.

ILLUSTRATIVE CASES TREATED BY THE MILLER-ABBOTT TUBE.

1. *Ileus from Peritonitis.* J.S.B., aged twenty-seven years, was admitted to hospital and at operation a gangrenous, ruptured appendix was removed. Semi-purulent fluid was present in the abdominal cavity, which was closed without drainage, though the superficial layers of the wound were drained. The next day intravenous therapy and gastric suction with a Miller-Abbott tube were instituted because of increasing distension and vomiting. For the next week he presented a picture of severe ileus with peritonitis. The Miller-Abbott tube did not enter the duodenum for three days, after which the patient's condition improved and intravenous therapy was stopped. Ten days after operation it was possible to remove the tube because the patient was eating well and his bowels were open. A free discharge occurred from the wound but no residual peritoneal abscess developed. The patient was discharged from hospital six weeks after his operation.

2. *Ileus from Peritonitis with Subsequent Mechanical Obstruction.* J.R.B., aged thirty-one years, was admitted to hospital on August 30, 1943, and had appendicectomy performed for a very acute obstructive type of appendicitis. After four days of normal convalescence he suddenly developed a very acute abdominal pain and other signs of peritonitis. The next day his abdomen was grossly distended and a Miller-Abbott tube was inserted and intravenous therapy commenced. He was given five grammes of sulphadiazine intravenously every day. His condition was desperate. Four days after his relapse, in his delirium, he pulled out his intravenous needle and the Miller-Abbott tube, which, at this stage, was half way down the small bowel. When pulled out, the bag was still inflated. The tube was immediately replaced. Four days later his condition was so much improved that the Miller-Abbott tube was removed, but was replaced because vomiting and distension recommenced. On the same day a pelvic abscess was drained. Twelve days after the relapse, he had obviously recovered from his ileus. His intestinal suction was stopped and the bag deflated. Because of intermittent attacks of small bowel obstruction, the tube was not removed for thirty-seven days and suction had to be recommenced several times. During this period, by plain X-ray examination and by injecting barium down the tube, it was shown that the last loop of ileum was obstructed and eventually this was deflated by the tube.

At this stage it would have been wise to have operated to remove his mechanical obstruction, but the possible magnitude of the operation weighed against this. The tube was removed. Four days later he had another attack of subacute obstruction which did not subside, so that an operation was performed three days later. Convalescence was uneventful.

3. *Ileus Following Operative Relief of Mechanical Obstruction.* H.G., aged thirty-one years, was admitted to hospital on March 21, 1945, complaining of pain and swelling in the abdomen for twenty-four hours. Twelve hours before admission he had commenced vomiting and had vomited copiously ever since. He had had a normal bowel action the previous day. He had been quite well until the day before admission.

At the age of eleven he had been operated on for intestinal obstruction. His appendix had been removed eight years previously and a herniorrhaphy was done six years later. He looked ill on admission and had a furred, brownish tongue and soft pulse. He presented a typical picture of small bowel obstruction of mechanical nature. An operation was performed in which many coils of terminal ileum were found matted together, there being no localized point of obstruction. A Meckel's diverticulum was found attached to the abdominal wall, but was not causing obstruction. The diverticulum was removed. After operation the patient was given intravenous injections of saline solution and one cubic centimetre of prostigmine every four hours. At first his condition was good, the systolic and diastolic blood pressures being 120 and 80 millimetres of mercury respectively, though he had sugar in the urine. He began vomiting two days after operation, and at this stage the Miller-Abbott tube was passed into the stomach. Considerable difficulty was experienced in passing the tube into the duodenum, this taking three days to accomplish. During this period the patient became very ill and at one stage was jaundiced. He developed basal pneumonia.

All this time the usual precautions about fluid, saline solution and blood administration were followed. After the tube entered the duodenum the patient's condition rapidly became better and it was possible to demonstrate with barium the actual obstructed loop and eventually to see the tip of the tube pass right to the ileo-caecal junction.

4. *Ileus Due to Trauma of the Posterior Abdominal Wall.* F.J., aged fifty-six years, was admitted to hospital on March 21, 1945. He had been knocked down by a motor-car and admitted to hospital within an hour or two with lacerations to the scalp but no fracture of the skull. He had contusion of the back and fractures of the eighth, ninth and tenth left ribs in the mid-axillary line. He gradually developed dilatation of both the large and small bowel. Two days later he had abdominal pain and vomiting. He looked very ill, with a rapid pulse, slight cyanosis and respiratory embarrassment. His abdomen was grossly distended and bowel action had ceased. By the next morning the tube was in the duodenum and from then onwards passed down the small bowel rapidly, with immediate relief of symptoms.

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I desire to thank the Director-General of Medical Services for permission to publish this paper.

DISCUSSION.

JOHN B. DEVINE: Many treatments for paralytic ileus have been suggested; these fall into three main groups: (*a*) "rest" of the bowel by repeated injections of morphine; (*b*) "stimulation" of the bowel with pituitrin, acetyl choline, and enemata; (*c*) employment of the Miller-Abbott tube. It appears, as a result of investigations being made by me, that each of these methods of attack on the condition is right at its own particular time.

Clinical material from which conclusions have been drawn are: 31 consecutive intubations with the Miller-Abbott tube, in many of which the balloon was connected to a recording tambour; a number of patients who have been treated by repeated morphine injections; and auscultation studies of the recovery of movements following "active ileus" after abdominal operations. In addition, in eight cases heat and turpentine stupes have been applied to the abdomen; barbiturates, pituitrin, trasentyn and atropine have been given to patients when the balloon was in position in the intestine and attached to a recording apparatus.

As a result of these studies on active and paralytic ileus the following tentative conclusions have been made.

There appear to be three distinct stages in recovery from paralytic ileus; these three stages are also found in recovery of movement after abdominal operations.

In the first stage there are no movements or sounds in the abdomen, and pituitrin or enemata do not produce fæcal or flatus result or increase or decrease in distension.

In the second stage there are uncoordinated movements in all directions. Pituitrin or enemata cause pain, upset to the patient, and may produce a small result, but the patient's distension increases rather than decreases soon afterwards. Stimulation thus increases the movements, but does not change their character from incoordinated to coordinated movements, but merely add to the internal confusion.

In the third stage there are coordinated movements—auscultation of the abdomen at this stage reveals sounds heard at fairly regular intervals—the turbulent and almost continuous borborygmi of the second stage do not occur. Pituitrin and enemata given in this stage result in adequate bowel actions with relief of distension.

Studies on intestinal movement with the Miller-Abbott tube connected to a recording drum both in patients with ileus and in a normal patient have given some interesting results throwing light on the everyday treatment of ileus. No difference in intestinal movements could be observed on three occasions when turpentine stupes and heat to the abdomen were used. Considerable diminution in movement was seen where barbiturates were given, even though given in mild clinical doses ("Luminal", one grain). Investigators have shown that atropine, trasentyn *et cetera* abolish intestinal movements, and that morphine decreases the propulsive motility of the bowel. On two occasions, however, when morphine was given in doses of one-sixth of a grain every four hours I could observe no difference in the balloon movements. On several occasions marked increase of motility was noticed following a serum transfusion.

If these three stages are accepted, treatment of paralytic ileus follows logically. In the first stage of a fully developed ileus with no bowel movements at all intubation is the treatment of choice if distension is marked, since the tube will pass down and stimulate bowel movements and empty the intestine from end to end like a vacuum cleaner (in one case it removed 240 ounces of fluid in thirty-six hours). In the second stage of uncoordinated movements bowel stimulation with pituitrin or enemata or aperients will increase distension and tend to bring on the first stages of complete ileus. (Too early stimulative treatment to the bowel in the second stage of recovery of movement after abdominal operations has seemed to be a factor in the development of ileus in several cases seen.) In six cases of this stage exhibition of one-sixth of a grain of morphine given strictly every four hours has resulted in a reduction of distension and recovery without further measures.

In the third stage, when movements are coordinated once more, stimulative treatment is safe and effective.

ACUTE PANCREATITIS.[1]

By ERIC M. NANSON,
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ACUTE PANCREATITIS is a sufficiently rare condition to be of considerable interest when it occurs, but to have four patients suffering from it admitted to a 500-bed hospital within five weeks is a remarkable occurrence worth recording. Four such patients in hospital at one time afford an excellent opportunity for comparison of symptoms and signs and assessment of treatment.

None of the four patients required operation; a positive diagnosis was made in each case by the diastase index and all recovered, being discharged at the end of three weeks' conservative treatment.

Case I.

Mrs. McG., aged sixty-two years, was admitted to hospital on September 3, 1945. She gave a history of having had sudden severe generalized abdominal pain four hours before admission, followed immediately by vomiting. The pain varied in severity, but never disappeared. Several years previously she had had her gall-bladder drained, but apparently no stones were found in it. Just previous to admission she had been discharged from another hospital after five weeks' treatment for heart failure, mainly evidenced by congestive bronchitis.

On admission her temperature was 101° F., her pulse rate was 84 and her respiratory rate 24 in the minute. She was an obese elderly, florid woman, in considerable pain, sitting hunched up in bed, with a definite bluish cyanotic tinge of her face and hands. The tongue was clean and the breath sour. The abdomen was obese, with a well-healed upper right paramedian scar. The abdomen moved slightly on respiration; there was generalized abdominal tenderness, acute in the epigastrium and above the umbilicus. There was guarding, but no true rigidity. There was definite tenderness in the left flank over the tail of the pancreas. Vaginal examination revealed no tenderness. The cardiac apex beat was found by percussion to be four and a half inches out from the mid-line in the fifth left intercostal space. The pulse was regular, the heart sounds were faint, but no murmurs were heard. The systolic blood pressure was 170 millimetres of mercury and the diastolic pressure was 110 millimetres.

A tentative diagnosis of acute pancreatitis was made. The following day she was still retching frequently and severe pain persisted. The tenderness had localized to the epigastrium. Her respiration rate was 40 per minute; dulness was present and the breath sounds had a bronchial element at the base of the left lung. X-ray examination of the lung fields showed some opacities at both bases, particularly the left, appearances consistent with congestive changes. The heart was large. The electrocardiograph showed no positive evidence of coronary thrombosis. The white blood cell count was 17,000 per cubic millimetre, with 79% polymorphonuclear cells, 18% lymphocytes and 3% monocytes. The urinary diastase index was 501+; Loewe's test gave a negative response.

The patient was placed in the Fowler position, given morphine as required and alkalis; heat was applied to the abdomen and sulphamezathine was given in doses of four grammes *statim* and two grammes every six hours for forty-eight hours, when it was discontinued on account of retching. She was very miserable for seventy-two hours, but from then on settled down well. The temperature fell by lysis and was normal on the fifth day. She was discharged well on the twenty-first day after admission.

Case II.

Mr. F., aged thirty-eight years, was admitted to hospital on September 22, 1945. Two weeks previous to admission he had had a short, sharp attack of epigastric pain. Twenty-four hours previous to admission this recurred and then regressed, but recurred twelve hours later, when he was woken up by severe generalized abdominal pain, maximum in the epigastrium, which was relieved by morphine. It was accompanied by seven to eight attacks of retching. He had had rheumatic fever in 1943, but no previous history of indigestion was elicited.

On admission his temperature was 99·4° F., his pulse rate was 120 and his respirations numbered 20 per minute. He was a young man, lying easily in bed, in no

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great distress; his face and hands showed a cyanotic tinge; the tongue was coated and the breath was sweet, the odour being possibly due to acetone. There was no rigidity, but generalized deep tenderness, maximal in the epigastrium, was present. The systolic blood pressure was 144 and the diastolic pressure 80 millimetres of mercury. Other systems were normal.

The white blood cell count was 13,000 per cubic millimetre, with 87% polymorphonuclear cells, 12% lymphocytes and 1% monocytes. The urine showed a trace of sugar and the urinary diastase index, estimated forty-eight hours after admission, was 80. A diagnosis of acute pancreatitis was made.

The patient was given expectant treatment, consisting of use of the Fowler position, the application of heat to the abdomen and the administration of morphine. In three days the temperature was normal, the cyanotic tinge had gone, and deep epigastric tenderness only persisted. The patient was discharged, well, on the thirteenth day after his admission.

Case III.

Mr. W., aged forty-five years, was admitted to hospital on October 2, 1945. He was admitted to a medical ward complaining of a dull ache, which had commenced gradually, some eight hours previously, while he was working; the pain was precordial at first and then moved down to the left iliac fossa. It increased considerably in intensity, making him sit hunched up. He vomited mucus twice. Prior to admission he had had half a grain of morphine and 1/150 grain of atropine, which made him very drowsy. He had had two similar but less severe attacks, one two years ago and one a year ago, which were relieved by aspirin and alkali.

On admission his temperature was 96·6° F., his pulse rate was 76 per minute and his respirations numbered 20 per minute. He was drowsy, with a deep cyanotic tinge in the face and hands; he was of asthenic build. The abdomen was retracted, but moved slightly on respiration. There was rigidity, maximal in the epigastrium, but not board-like. The left rectus muscle was more rigid than the right. There was definite deep tenderness in the left flank over the tail of the pancreas and lateral to the left kidney. The systolic blood pressure was 140 and the diastolic pressure 80 millimetres of mercury.

A provisional diagnosis of acute pancreatitis was made. Twelve hours later the white blood cell count was 27,000 per cubic millimetre, with polymorphonuclear cells 22%, lymphocytes 64%, and monocytes 14%. The urinary diastase index was 260. A second count three days later showed the white cells to number 18,000 per cubic millimetre, with polymorphonuclear cells 54%, lymphocytes 40% and monocytes 6%. A second diastase test three days later gave an index of 64.

The patient was treated expectantly in the Fowler position with heat to the abdomen; alkalis were given, and his pain, tenderness and cyanotic tinge subsided gradually over the next seven days. His temperature, which rose to 100·4° F. twelve hours after his admission, and his pulse rate, which rose to 90 per minute, fell to normal by lysis on the fourth day. On account of associated tenderness over the gall-bladder a Graham's test was carried out and showed no gall-bladder shadow and no calculi. He was discharged, well, on the thirteenth day.

Case IV.

Mr. T., aged forty-six years, was admitted to hospital on October 4, 1945. He was cooking five hours before admission, when he was seized by sudden severe cramp-like pain in the left iliac fossa. The pain moved to the epigastrium, where it persisted; it was exacerbated by severe spasms, which made him sit crouched up. He did not vomit. He had aching pain in both shoulder tips, more marked on the left. He had had a moderate "binge", having consumed seven bottles of beer seven days previously, and his digestion had been upset since then. He had had a similar short, less severe attack five years previously and another one two and a half years previously, for which he was in hospital for eight days, with no investigations made, however.

On admission his temperature was 99° F., his pulse rate was 96 per minute, and his respirations numbered 20 per minute. There was marked cyanosis of hands and face; the tongue was furred and there were five grossly carious teeth in the lower jaw. The abdomen moved slightly on respiration, with marked guarding and tenderness over the epigastrium, extending down to the umbilicus, but no absolute rigidity. Gastric lavage yielded clear fluid and removed a small amount of gas distension from the stomach. Twelve hours after admission severe colicky pain recurred in the epigastrium, but the signs were unchanged. Rectal examination revealed nothing abnormal. The systolic blood pressure was 120 and the diastolic pressure was 70 millimetres of mercury. The white cell count was 23,000 per cubic millimetre, with polymorphonuclear cells 77%, lymphocytes 22%, and monocytes 1%. The urine showed a diastase index of 128.

A diagnosis of acute pancreatitis was made. Two days later Loewe's midriatic test gave a positive result. Three days later the diastase index was down to 64. A straight X-ray picture of the lung fields taken on the day of admission showed some opacity of the bases of both lungs and what was thought to be a gas shadow below the diaphragm on the right side. The temperature, which had risen to 102° F., and the pulse, which had risen to 110 per minute twenty-four hours after admission, settled to normal by lysis on the eighth day, and, clinically, all pain and tenderness had gone. A Graham's test done on the twelfth day showed no gall-bladder shadow.

He was treated expectantly in the Fowler position, with morphine, alkalis and tincture of belladonna, and the application of heat to the abdomen. He was discharged, well, on the fourteenth day.

Discussion.

Obviously these were four cases of acute pancreatitis of moderate severity only, not requiring laparotomy. It is interesting to note that, over the post five years, only twelve patients with authenticated acute pancreatitis were admitted to this hospital, and yet over the past five weeks four further cases have been seen. In all four cases certain points of similarity in histories, symptoms and signs occur.

In three of the cases there was a history of previous upper abdominal pain. In Case I a cholecystostomy had been performed, which suggests possible pancreatic trouble at that time. In Case II no previous history was elicited, but in Cases III and IV two similar previous attacks are recorded.

In Cases I, II and IV the onset of pain was sudden and severe. In Case III it was of gradual onset and shifted position. In all four cases the pain persisted, but was subject to exacerbations which, in Case IV, suggested colic in nature. A crouching position was adopted in all four cases. Morphine in heavy dosage relieved pain. The maximum intensity of the pain was noticed midway between the umbilicus and the xiphisternum, over the left rectus muscle. In Cases I and III definite tenderness was present over the tail of the pancreas in the left flank, well anterior to the left kidney. Retching was a feature in Cases I, II and III, but absent in Case IV prior to the patient's admission to hospital; it occurred twice subsequent to admission.

Cyanosis of the hands and face was a marked feature in all four cases.

The temperature was low on admission in Cases II, III and IV, but rose to 100° to 101° F. within twenty-four hours. The pulse rate was not above 100 except in Case II; but in this case it fell to 100 within twenty-four hours. The blood pressure was sustained to approximately the expected normal levels for the individual patients prior to their illness.

Rigidity was present in all four cases, but never to the marked degree experienced in a case of perforated peptic ulcer, and respiratory movements of the abdomen were present.

In all four cases the urinary diastase index was raised. In Case I it was over 500, whilst in Case II, the mildest of the cases, it was 80; but this was taken forty-eight hours after the patient's admission to hospital. In Cases III and IV it had fallen by half at the end of three days.

The white blood cell count was raised in all cases with a polymorphonuclear increase, except in Case III, in which there was a remarkable and inexplicable lymphocytosis, which persisted in a repeat count made three days later.

A Graham's test done in Cases III and IV showed no gall-bladder shadow, but no calculi opaque to X rays. In Case I no test was done, as it would be unreliable on account of the previous cholecystostomy; and in Case II the test was not considered necessary.

Quick,[1] in his review of acute pancreatitis, classifies the disease into acute pancreatic œdema, acute hæmorrhagic pancreatitis, acute gross pancreatic necrosis and suppurative pancreatitis; the last three types are grave conditions with a high mortality, and, therefore, it suggests that the four cases reported fall into the category of acute pancreatic œdema. Quick stresses the importance of a previous history of attacks, which occurred in three of the above cases. He also notes the sudden onset of the pain, the possibility of exacerbations and remissions, and the importance of its epigastric position radiating to the left. Tenderness in the left flank is also stressed. Retching rather than vomiting is a notable feature and serves to differentiate the condition from an acute perforation of a peptic ulcer, in which retching is unusual. Quick also notes that rigidity is rarely absolute and often absent, and he also records the low temperature and slow pulse; he fails, however, to record the blood pressure, which, in the four cases described, was sustained at what was estimated to be normal levels. In none of the four cases was there a fall of pressure such as one associates with shock. Another sign which Quick mentions but does not stress is the peculiar cyanotic tinge of the face and hands, which was most marked in these four cases.

The value of the urinary diastase test is upheld by Muskin.[2] He states that any patient showing 50 units or more urinary diastase is suffering from acute pancreatitis. He also states that the sooner the test is performed after onset of the illness, the higher will be the diastase reading obtained. It returns to normal or near normal in three to four days, and that the fall is rapid is shown by Cases III and IV. Muskin states that the test is 100% accurate in cases of acute pancreatitis.

As regards treatment, conservative methods were used in all four cases with good results, and only a follow-up of the patients will reveal whether this was justified. Quick,[1] John B. Dreaver,[3] and Archibald[4] all advocate surgery on the biliary tract, but if the condition can be induced to settle down by conservative means and further tests for gall-bladder disease give negative results, then no further surgery is indicated.

Summary.

1. Four cases of acute pancreatitis are recorded.
2. The symptoms and signs of these cases are compared.
3. The value of various features in each case is discussed as an aid to diagnosis.
4. Conservative treatment with recovery is recorded.

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[2] M. Muskin: "Urinary Diastase in Acute Pancreatitis", THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY, October, 1932, page 133.

[3] John B. Dreaver: "Pancreatic and Peripancreatic Disease", *The Journal of the American Medical Association*, Volume xxxvii, July 16, 1921, page 194; "Pancreatitis", *Surgical Clinics of North America*, 1921, page 1.

[4] E. Archibald: "Acute Œdema of the Pancreas", *Annals of Surgery*, Volume xc, November, 1929, page 803.

Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

TOTAL GASTRECTOMY.

W. Wagner (Halle): *"Zur Frage der totalen Magenexstirpation"*, *Archiv für klinische Chirurgie*, Volume ccv, September 21, 1943, page 101.

THIS discussion of the technique, dangers and results of the operation of total gastrectomy is prefaced by the report of two of Wagner's own cases (one of the patients died, the other lived) as illustrations of the special methods required to carry this dangerous and extensive operation through to a successful conclusion. The operation discussed is the true total gastrectomy, which leaves behind no gastric mucosa either at the cardiac or the pyloric end. The whole matter of the danger of the operation rests on the union of non-peritonealized œsophagus to jejunum.

The incision chosen should vary with the build of the patient and should be only the one which in the surgeon's opinion will give the best exposure in that particular patient. After the opening of the peritoneum the stomach, with its lymphatic glands, is isolated, any adhesions to the liver or pancreas being divided by sharp dissection. Contrary to Kirschner's advice, manipulation is made easier by commencing the isolation at the duodenal rather than at the cardiac end; and it makes for greater ease still if the duodenum is cut through early. During the freeing of the cardiac end it is particularly important not to damage the œsophageal wall by including part of it in a suture, and this is not always easy to avoid. When the stomach is drawn down by means of either a rubber strap or gauze, the lowest part of the œsophagus comes into view. The peritoneum over the front of it is split in an inverted T-shape, and the two flaps are stripped back until the two vagi become visible. These should be infiltrated with "Novocain" and cut with a sharp knife. Undue traction on the vagi may have reflex effects on the circulation or respiration which may be fatal. Another real danger at this stage is that of opening into one or both pleural cavities, and an intratracheal pressure apparatus should be kept handy.

The anastomosis is made by uniting the cut end of the œsophagus with the side of the first loop of the jejunum, and on the successful suturing of this anastomosis the success or failure of the operation depends. Sutures are best used interrupted, each knot being tied to the next. The posterior musculo-serosal layer is put in before the stomach is divided. The cardia is clamped, sometimes the œsophagus also, and, the cardia being divided, the posterior mucosal line of sutures is inserted, followed by the two anterior layers. For further security the reflected peritoneum is sutured to the jejunum, and finally the jejunum itself is fixed by a few sutures to the under surface of the diaphragm. Some surgeons have advocated elimination of diaphragmatic movement by paralysing the phrenic nerve; but this is not really helpful, since the resultant diaphragmatic position is at its highest and likely to increase any tension on the duodenum. More important than such a procedure is the suture of the jejunum to the œsophageal aperture of the diaphragm all round, before it is covered with the peritoneal flaps. The final step in the operation is the construction of a side-to-side anastomosis between the afferent and efferent loops of the jejunum, to relieve the afferent loop of undue load. Two points in the technique which are emphasized are the wisdom of avoiding the use of a clamp on the œsophagus end in view of the danger of damaging its blood supply, and the need to avoid continuous sutures, which have before now led to stenosis.

In the after-treatment Wagner departs from the teaching that nothing whatever must be swallowed for a considerable time. Even if a nutritive jejunostomy is made, saliva must still be swallowed; and he prefers the more moderate course of parenteral nourishment by intravenous administration of saline solution and glucose, serum and whole blood, while sips of tea are allowed on the third day and semisolids on the eighth. Drainage is regarded as a useful safeguard, tubes being placed under the left and sometimes under the right dome of the diaphragm until the absence of discharge shows that it is safe to remove them.

These patients being obviously left without their normal food reservoir, various suggestions have been made and tried to give some substitute for it. They have not been encouraging, and it is evident that no substitute can be effected for the pyloric sphincter. Wagner holds to the view that the operation should not be unduly prolonged

and the patient consequently endangered by attempts to replace stomach space. Physiologically, the main lack is hydrochloric acid and pepsin, and though these can be added in the diet they are quickly neutralized by the alkaline jejunal fluid and are not effective. Digestion, however, seems to be curiously efficient in all elements after total gastrectomy, the main difference being the patients' intolerance of very hot or very cold foods.

The first ten days after the operation are days of anxiety in every case. The early danger is shock, against which 300 to 400 cubic centimetres of blood should be given along with the other usual remedies. In the middle post-operative period, cardiac, pulmonary and abdominal complications must be expected, especially the dreaded peritonitis from breakdown of the suture lines. Once this period is successfully passed the patient should be encouraged to exercise his limbs freely in bed by about the seventh to the eighth day, and if all is well he may get out of bed on the tenth or twelfth. Meals have to be small and frequent and of pulpy consistence, and this *régime* must be maintained after the patient leaves the hospital.

In the later stages anæmia is a problem. A secondary anæmia is common. The Addisonian type is fortunately rare, but does constitute a late risk for the patient, occurring as it does years after the operation.

This formidable operation, with its high mortality, should not be undertaken lightly. It is doubtful if it should ever be performed on an unquestioned diagnosis of simple ulcer. When cancer is present or suspected, the justification for the operation is that it offers the only hope of survival to the patient; it does relieve him from a great deal of pain and distress and does prolong his life for a varying number of years. Nonetheless, in the attack on gastric carcinoma, further development of means of early diagnosis is more important than further development of the technique of total gastrectomy.

ARTHUR E. BROWN.

TOTAL RESECTION OF THE PAROTID.

Henri Redon (Paris): "*Technique de la parotidectomie totale, avec conservation du nerf facial*", *Journal de Chirurgie*, Volume lxi, 1945, page 14.

NEVEU in 1941 wrote an excellent thesis on this subject; but Redon is of opinion that this work leaves too much to the individual decision of each surgeon in a subject in which it is very difficult to gather a large experience. Redon writes after an experience of more than fifty such cases, and his technique follows Neveu's thesis moderately closely.

A special armamentarium is almost necessary for this work. Fine hæmostatic forceps of the Halstead type are needed. A fine, curved, blunt-pointed scissors of the type used in ophthalmic work is advisable for the dissection of the nerve. And particularly, a stout "spreader" type of self-retaining retractor is of the utmost value in forcing apart the maxilla from the mastoid process to gain access to the deeper parts.

This operation carries no special risk if done under general anæsthesia, but it can be performed with local analgesia, provided that a regional block of the first cervical pair of nerves (particularly their ascending branches) and of the trunk of the inferior maxillary nerve as it leaves the skull is carried out at the same time. The incision should commence well above the zygoma, travelling down in front of the ear to the lobe, where it turns horizontally backwards to reach the sterno-mastoid muscle. Here it turns downwards again and runs down for a good two fingers' breadth along the prominence of this muscle. After preliminary clearing the posterior layer of the sterno-mastoid sheath is opened and the vascular channel exposed. The lower pole of the parotid is seized in Farabœuf forceps and lifted up; the anterior insertion of the maxillary ligament is cut. After the clearing of the digastric muscle the posterior border of the maxilla and the anterior border of the mastoid process, the spreading retractor is placed between these two bony margins and they are forced apart. Provided that the size and situation of the tumour permits of it, the external carotid artery is now clamped and divided. Isolation and ligation of the temporal pedicle of the gland are easy, and traction on the freed upper pole reveals the retro-articular plane of dissection, marking the area where the more adherent zone must be dissected. The whole posterior border of the gland being thus freed, a space more than two centimetres wide is exposed. The only area not thus made easily accessible is that adjoining the lower margin of the auditory canal above the digastric muscle. At this level some cellular tissue unites the gland with the temporal plane and protects and conceals the facial nerve. The stylomastoid artery, which runs in this tissue, is a good guide to the nerve. It must be cut and tied with caution and under full vision, and immediately deep to it the nerve becomes clearly visible. Provided the maxilla is well forced forward, the nerve can be cleared for two centimetres of its course without great difficulty.

The remaining steps of the operation demand only patience and care. It is after this stage that the position and size of the tumour become of importance. In a primary operation, in which the tumour does not specially complicate the technique, the steps taken are as follows. Splitting of the gland and the isolation of its superficial lobe are relatively simple. It is started at the point of entrance of the nerve and followed down to the lower pole. Once the cervico-facial branch of the nerve has been rendered visible, the superficial lobe is pulled up by forceps and the dissection is carried out step by step by fine ophthalmic scissors; the dissection separates off the lobe and cuts through the fine glandular branches of the nerve and the venules until the anterior border of the gland is reached in front and the isthmus of tissue between the two lobes above. The site of this isthmus, which varies greatly in its relation to the branches of the facial nerve, has a bearing on the ease of the succeeding steps. It may lie above the superior branch or it may be embraced by the separating branches of the main nerve; the latter situation produces the greater difficulties, in that it is necessary to leave the routine clearing of the inferior branch and seek out the correct plane of cleavage for the superior branch from its origin from the facial trunk.

In either case the isolation of the gland involves nowhere more than the freeing of the nerve, not an actual dissection of it. The superficial lobe being cleared and isolated, the nerve is seen in high relief on the surface of the deep lobe. Each main branch is picked up in a loop of fine rubber and delicately freed from the underlying gland surface with fine ophthalmic scissors. It is at this stage that damage of different severity may be occasioned to the nerve and its branches. The dissection is much simpler if the main trunk divides late into its manifold branches.

Once the main nerve and its branches are separated in the manner described from the surface of the deeper lobe, the latter is easily enucleated, only the internal maxillary pedicle in front and the point of adhesion of the gland to the temporo-maxillary articulation posteriorly being likely to cause any difficulty. Hæmostasis of the internal maxillary pedicle can be the most difficult step in the whole operation. It must be achieved with care and patience, for to try to catch a bleeding and retracted internal maxillary artery is an unenviable experience. Finally, there are two venous pedicles which are not given their due prominence in anatomical works. One of these is the extracondylar venous pedicle; the other a veritable venous plexus uniting the deep surface of the parotid with the masseter muscle near the angle of the jaw.

In cases of recurrent or severely invasive tumours, when sometimes dissection of the nerve peripherally from its bifurcation is impossible, its superior branch may be sought deep to the aponeurosis about two centimetres in front of the temporal pedicle. This point is always easily dissectable and bleeds little, and the branch is nearly always single and large enough to be easily identified. Dissection backwards from this point will lead to the bifurcation. Sometimes the tumour mass makes the early division of the external carotid artery difficult, in which case it may be left till a later stage.

Some writers consider the removal of the deeper lobe unnecessary, but in view of the frequency of aberrant tumour nodules and the ease of this particular step, Redon considers it should always be done.

ARTHUR E. BROWN.

GASTRECTOMY IN RELATION TO GASTRIC ACIDITY.

Victor Hoffmann (Cologne): *"Über die Sauresverhaltnisse im Geschwürsmagen und ihre Beinflussung durch die Resektion"*, *Archiv für klinische Chirurgie*, Volume ccv, September 21, 1943, page 76.

IT is regarded as axiomatic in gastric surgery that the acidity of the gastric secretion is responsible for the formation of jejunal ulcers after anastomosis, and the expressed aim of the majority of surgeons is to perform a gastrectomy sufficiently extensive to eliminate this acidity.

Hoffmann's thesis is that the degree of acidity after gastrectomy is quite independent of the extent of the resection, and he quotes a fairly extensive series of clinical studies to support it. In 1939 he published a series of 366 cases in which resection of the antrum was definitely not complete. In this series the incidence of jejunal ulcers after from six to ten years was less than 2%. Since 1930 he has himself performed at Cologne a deliberately limited gastrectomy on peptic ulcer patients more than 3,000 times. The incidence of jejunal ulcer in these cases is still less than 2%. The more extensive gastrectomies cannot show an incidence less than this. Finsterer's figures published in 1929, of five anastomotic ulcers following 46 limited gastrectomies and two following 42 extensive resections are open to question, since the incidence after this series of limited gastrectomies is greater than that usual after simple gastro-enterostomy. Accurate statistics on the matter are almost entirely lacking. The position is clouded by statements such as that by Borger in 1942, to the effect that "a limited gastrectomy fails to eliminate the hyperacidity and thus leads to jejunal ulcer", while at the same

time he reported two cases of jejunal ulcer after extensive resection. Clinical study of the gastric secretion does not indicate the necessity for the extended resection, since numerous reports show that hyperacidity may persist after it.

Therefore in 1939 Hoffmann commenced careful and repeated studies of the gastric acidity before and at stated periods after all operations of gastrectomy. The post-operative times of estimation were eighteen days, three months, one year and three and a half to four years. Alcohol was used for the test meal, and in the final test histamine was also used. The general clinical condition of the patients was judged by their intake of milk, sweets and leguminous vegetables, as well as by their well-being.

In the series under study, of 203 cases, 74% were duodenal ulcers, and of these cases 78% showed a pre-operative hyperacidity. Of the gastric ulcers, 28% showed a normal acidity before operation when the ulcer was in the pyloric region, while when the ulcer was in the proximal part of the stomach hyperacidity was the exception. All the operations were performed by the same surgeon, using the same technique, in that the removal of the gastric antrum was deliberately incomplete.

According to the post-operative acidity curves, the cases were grouped into six classes, as follows. In Group A the positive acidity curve became anacid immediately after the operation and remained so. The final curve was negative to histamine stimulation. In Group B the positive acid curve became normal immediately after the operation, and after three months indicated anacidity; this condition remained and no reaction to histamine was recorded. In Group C positive acidity remained longer, but after one to four years the curve became negative or very weakly positive; this was a small group. In Group ABC immediately, and also later, the curve shows no free acid after the alcohol test meal, but after histamine stimulation shows a sharp rise. In Group D the post-operative curve is high, and later, though less high, remains above normal acidity. In Group E the post-operative acidity is as high as before operation or even higher.

From this grouping the following observations were made:

1. In the first five groups a diminution of acidity is achieved in from three to four years, but in a certain number of them some degree of acidity persists.

2. The functional diminution of the acidity has no relation to the amount of stomach removed. In Group A, with immediate anacidity, and in Group E, with persistent high acid secretion, the resected portions were identical.

3. The pre-operative acid curve may give some indication of post-operative behaviour. Of those cases with normal pre-operative curves, 75% had anacid curves after gastrectomy, while of those with pre-operative hyperacidity curves, only 25% of curves became anacid.

4. Time itself is a significant factor, for while some of Group A curves became negative immediately, more became so with the passage of time. With the passing of further years Group C will probably increase in numbers at the expense of Groups D and E, but even after ten years some normal and hyperacidity curves can be found. On the other hand, a return from an early anacidity to a later acidity curve is very rare. This was noted only once in a ten-years series, not at all in a four-years group. It is evident from the foregoing that any single fractional acidity curve can be properly evaluated only in relation to those prior to and subsequent to it. Otherwise there is no distinction between an accidental and a stabilized anacidity.

In both of Hoffmann's series (1939 and the present one of 1943) the results after three to four years of the resection of about one-third of the stomach with retrocolic end-to-side anastomosis are very constant: 85% to 88% very good. Results were generally good with occasional indigestion in 8% to 10%; improvement occurred but some pains remained in 2% to 3%, and jejunal ulcer occurred in 1·1%. Hoffmann has set these results out graphically in this table. It will be noted from the table that of

	Eats Anything.	Uses Care with Milk, Sweets and Legumes.	Well, but have Some Dyspeptic Symptoms.	Improved.	Jejunal Ulcer.		Any Other Ill Results.
					Known.	Suspect.	
Anacid	44	18	10	2	0	0	1
Alcohol negative, histamine positive	20	6	2	1	0	0	0
1 to 20	4	2	2	0	0	0	0
21 to 40	25	8	2	0	0	0	0
Free hydrochloric acid—							
41 to 60	7	4	0	0	1	0	0
Over 60 + ...	7	0	0	0	1	0	0
Questioned only	20	7	0	1	0	0	0
Not traced	1	—	—	—	—	—	—
Dead	7	—	—	—	—	—	—

all those patients wholly symptom free after three to four years more than one-third had an acid curve rising above 20. Both of the only two jejunal ulcers known or suspected occurred in the first post-operative year.

If one considers that in this series of limited gastric resection there was an incidence of jejunal ulcer of less than 2%, and that some 90% of patients with persistent hyperacidity have no signs of recurrent ulcer, one may affirm definitely that a persistent acidity following gastrectomy carries no danger to the patient and that such late sequelæ as were observed were not due to any particular grade of acidity.

The secretory function of the stomach is not directly affected by a diminution of the mucosal area. The effect produced on the acid curve is most probably achieved through the medium of the vegetative nervous system. The output of acid returns in some cases immediately, in others after a short time of working and in others only gradually after some years.

The principle of countering the acidity, thus "breaking the vicious circle", as the aim of gastric surgery is in Hoffmann's view a faulty one. The question whether and how the more extensive gastrectomies affect the acid curve after a period of years needs much closer study than it has so far received.

ARTHUR E. BROWN.

PEPTIC ULCER IN MECKEL'S DIVERTICULUM.

Jørgen Lund: "*L'ulcère peptique du diverticule de Meckel*", *Acta chirurgica Scandinavica*, Volume xcii, 1945.

AFTER a discussion of general points in connexion with peptic ulcer in Meckel's diverticulum and a report of four cases of his own, Lund enters into a clinical study of the condition as met with in practice. It is predominantly met with in boys to the extent of 82%; 50% of the patients are under five years of age, 70% under ten years, 80% under fifteen years, and 90% under twenty years of age. Contact is first made with the patient in the great majority of cases owing to an acute emergency—perforation or hæmorrhage—although the literature contains many instances of a chronic type of onset.

The chief complaint met with is that of abdominal pain, which is rather vague in type and localization, sometimes persistent, but occasionally colicky. The pains occur generally during the day at irregular intervals. Adult patients often notice a definite time relation between the taking of food and the onset of pain. This is understandable, but it is less easy to see why some of the patients find themselves eased of pain by the taking of food or of alkalis. The symptoms are remittent, the free intervals lasting for months or even years. There is little that is diagnostic in the story so far, but the association of rectal hæmorrhage is of great importance. It has in this disease two characteristics: it is sudden and it is profuse. It has the same remittent character as has the pain, though there does not seem to be any essential relationship between pain and hæmorrhage.

The earliest onset of hæmorrhage reported was in a child two days old. When bleeding occurs in these cases the blood flows in considerable quantity, mixed with fæcal matter, but without mucus. It clots freely and the passage of clots in a child should draw attention at once to the likelihood of Meckel's diverticulum and ulceration. Melena is not usual, except at the end of a bout of freer hæmorrhage. Severe anæmia is produced, the average hæmoglobin value following it being 40% to 50%, though it may go much lower. Vomiting may occur during the hæmorrhage, but if it does it is a suspicious sign that perforation may be impending. Passage of blood of type other than that described is not usual. Whether or not occult blood may be discovered in the fæces in the free intervals is a point not clearly decided in the literature. In the absence of perforation, clinical examination of these children is not very informative. Abdominal tenderness is rarely found, and rectal examination, except for the possible presence of clots in the rectum, does not help. It is at this stage, however, that operation yields its best results.

Once perforation has occurred the chances of survival are considerably lessened, and perforation is a more likely complication of an ulcer in Meckel's diverticulum than it is of a similar ulcer in the stomach or duodenum. Perforation had occurred in 59% of cases reported. The symptoms of such perforation are less dramatic than those of a gastric perforation, for instead of the jet of highly acid fluid from the stomach there is a slower seepage of comparatively non-irritating fluid from the diverticulum. When pain has been a symptom of the ulceration, perforation often occurs during an attack, and the nature of the pain then changes, becoming severe and colicky. Vomiting of persistent type indicates peritoneal irritation. The pain, at first subumbilical in position, spreads to other abdominal areas, and the picture of general peritonitis supervenes, unless the ulcer is fortunately shut off by adhesions. In Lund's series of patients with a history of hæmorrhage there were only three whose perforation

occurred apart from a hæmorrhagic attack. In consequence, all hæmorrhages should be regarded as potentially portending perforation. When no previous history of abdominal illness exists, it is possible only to make a diagnosis of perforation and to define the exact cause by laparotomy.

It is easily understandable that the diagnosis is difficult, but with increasing experience it can be made in a constantly greater proportion of cases. Out of 136 published cases a pre-operative diagnosis was correctly made in 33. The condition can be expected in male infants and young men, and the type of hæmorrhage met with is quite characteristic. Free rectal bleeding, with the passage of clots and occasionally melena, should arouse suspicion. Pain is less important, but its relation to food in older patients may be significant. In many children an examination of the umbilicus may in itself convey the idea that the omphalo-mesenteric canal has not closed normally. A retracted, trough-shaped, or unduly protruding navel may be such an indication, and in the case of some children there has been a history of an unduly persistent umbilical fistula after birth.

Differential diagnosis must take account primarily of intussusception. One must bear in mind that in intussusception the blood which escapes is much less in quantity and is mixed with mucus rather than with fæcal matter. The tumour, too, and the development of early obstructive symptoms are symptoms of intussusception rather than of diverticular ulceration. X-ray examination of the abdomen should clear away any doubts.

Gastro-duodenal ulceration with hæmorrhage is so rare in childhood that it can be practically dismissed from consideration. Abdominal purpura, on the other hand, in the early stages before petechiæ have appeared, may be quite impossible to distinguish from diverticular ulceration.

The prognosis depends entirely on early operation. In the published series of 127 cases, 75 patients were operated upon after perioration had occurred, and of these, 18 died. But of the remaining 52, who were operated upon before perforation occurred, none died. In these series nine patients did not have the diverticulum removed, and these nine, irrespective of whether they had suffered from perforation or not or whether they had been operated upon or not, all died. Lund's conclusion, therefore, is that all treatment of a diagnosed peptic ulceration of a Meckel's diverticulum other than operative is entirely inadmissible and that correct surgical treatment involves the resection of the diverticulum.

ARTHUR E. BROWN.

THE RESECTION OF PENETRATING DUODENAL ULCERS.

Erik Brattström: "*Duodeno-gastrectomie dans les cas compliqués d'ulcère pénétrant et de tumeurs péri-ulcéreuses*", *Acta chirurgica Scandinavica*, Volume xcii, 1945.

THOSE cases in which a penetrating ulcer of the posterior wall of the duodenum has infiltrated the surface of the pancreas and the region of the common bile duct cause many surgeons to withhold radical surgical treatment because of the danger of damaging the duct. Brattström has evolved a technique to make such radical surgical treatment easier and safer.

When the position has been explored, a small opening is made in the greater and lesser omenta, through which a clamp can control any flow of gastric secretions into the duodenum. The duodenum is then shut off by packs put laterally to it and into the right renal area. The left index finger then explores the foramen of Winslow behind the hepato-duodenal ligament. The common duct is cleared in this region, and after its identity has been established by aspiration of bile, a small incision is made into its anterior surface between two fine stay sutures. Through this incision a fine catheter or sound of semi-soft rubber is passed down into the duodenum. This sound must be large enough to be easily palpable to the finger, and it forms a guide throughout the operation to the exact position of the common bile duct.

The anterior wall of the duodenum is then cut through below the tumour level and the ulcer on the posterior wall is exposed to view. The lower edge of the inflammatory infiltration is located, and the posterior wall of the duodenum is cut through below this lower edge, access thus being given to the retroduodenal tissue planes. With the left forefinger in the foramen of Winslow palpating the sound in it, the duct is in no danger of accidental damage, and the freeing of the posterior wall of the duodenum can be carried out with a much greater sense of security, as well as ease. The duodenal stump is thus freed downwards and closed and invaginated, its posterior bare surface being covered over by peritoneum.

The next step is to separate the inflammatory mass and the duodenal bulb from the pancreas; and the open view afforded by the technique described, the dissection being made from below upward and under the constant control of the palpating finger in the foramen, makes it much easier to avoid cutting and tying pancreatic tissue.

Operative damage to the pancreas, with its accompanying danger of pancreatitis, has marred many technically successful operations. The technique here set out also gives much increased protection to the pancreatic ducts during this dissection. When this stage is completed, the rest of the resection is on routine lines. The sound is withdrawn from the common duct, and the small wound of entry is closed. A drain is brought out through a stab wound in the right loin.

Brattström has used this technique in eight cases with uniformly satisfactory results. He has seen no post-operative complications, and his patients have been discharged from hospital in from fifteen to eighteen days after the operation.

ARTHUR E. BROWN.

Reviews.

A Manual of Tuberculosis. By E. ASHWORTH UNDERWOOD, M.A., B.Sc., M.D., D.P.H.; Third Edition; 1945. Edinburgh: E. and S. Livingstone. 7½" × 5¼"; pp. 524, with 88 illustrations. Price: 15s.

THE author opens his preface with the following remark: "The needs of those who approach the subject of tuberculosis work as something more than a mere item in the course on clinical medicine have been borne in mind", and this is the foundation stone on which he builds up a very comprehensive and readable study of this disease.

As he has such a wide field to cover, it is not possible for the minutiæ of clinical diagnosis to be emphasized, but this in no manner detracts from the work since, in modern medical teaching, it is these points which seem to be stressed most. In their place he has been able to devote time to the very important aspect of the psychological outlook of these patients. Anyone who has had to treat patients suffering from tuberculosis, particularly adults, will realize the very real importance of this and the author is to be congratulated for a well-written chapter on the subject. The major emphasis is on the pulmonary form of the disease, and this is the best part of the book. We cannot help feeling that the section on surgical tuberculosis, particularly of the genito-urinary system, suffers by comparison and by its brevity. It would have made the book more comprehensive had more space been devoted to these forms of the disease and less to the electrophysics of radiography which seems rather out of place in such detail in a book of this nature.

The author intended this book to be read by non-medical people associated with the treatment of tuberculosis, and while this is a worthy aim, medical readers will probably be irritated at times by his detailed explanation of well-known phenomena and use of "lay terminology". One other point of criticism is the understatement of the dangers of gold therapy and the complications of internal pneumolysis. However, these are comparatively minor points, and anyone interested in tuberculosis as a disease will find a great deal of useful information here written by someone with long experience of the disease.

The 1945 Year Book of Industrial and Orthopedic Surgery. Edited by CHARLES F. PAINTER, M.D.; 1945. Chicago: Year Book Publishers, Incorporated. 7" × 4½", pp. 432 with 225 figures. Price: $3.00.

THIS cornucopia of industrial and orthopædic surgical knowledge is an essential for those interested in the subjects.

The most discussed subjects in the year's orthopædic literature have been arthritis, osteomyelitis, and infantile paralysis. Disarticulation of the innominate bone for malignant tumours of the pelvic parietes and upper part of the thigh is considered critically, and the editor advises both surgeon and patient to weigh the hazards of this difficult and doubtful procedure except for innocent growths. Treatment of compound fractures by early wound suture—after excision—and local instillation of adequate amounts of penicillin appear to have proved successful in maintaining sterility leading to bony union of compound fracture wounds; but parenteral administration of penicillin cannot sterilize avascular bone fragments *et cetera* around a fracture.

Plating of fractures is probably becoming too popular because plates and screws are now non-corrosive (electrolytic). Sound internal fixation facilitates healing in good anatomical position, and external splints are avoided or their use is less frequent, the period of disability being thus shortened. Internal fixation after a trochanteric osteotomy is shown to be an advantage because it does away with the long period of plaster fixation. Kellogg Speed states that the frequency and seriousness of infection following internal fixation of fractures of the femoral neck are seldom admitted in

published papers. He advises the administration of penicillin (100,000 units intravenously in the first twenty-four hours and 10,000 units every four hours thereafter) as a prophylactic against operation infection. Total patellectomy should be performed only when a reasonable degree of anatomical reposition cannot be achieved.

In cases of recent fractures, the long (12-inch) medullary pin, V-shaped in section (prescribed by Kuntscher in 1940) is recommended mainly for fractures of the femur and is inserted through the greater trochanter; for other long bones it is necessary to make a suitable hole (if possible) and this presents difficulties. The V-section does no great harm to bone marrow, and external splinting and stiff knee *et cetera* are largely avoided and early ambulation is usual; but the serious risks of this operation are obvious.

Demonstrations of Operative Surgery for Nurses. By HAMILTON BAILEY, F.R.C.S.; 1945. Edinburgh: E. and S. Livingstone. $8\frac{3}{4}'' \times 5\frac{3}{4}''$; pp. 348, with 531 illustrations. Price: 21s.

HAMILTON BAILEY has written a series of running commentaries on the details of various operations which a nurse is likely to witness during her period of duty in an operating theatre. Each commentary is profusely illustrated, many illustrations being in colour. The opening chapters deal with general principles, and in all there are eighty-three commentaries, covering practically every type of operation on adults and children, including gynæcological operations and those of the eye, nose and throat. As in other of Bailey's books, a pleasing feature at the foot of each page is the brief bibliography of the surgeons mentioned in the text. While the names of those who have assisted in the description of special operations are printed on one page and there is a good index, it is surprising that there is no table of contents.

This volume will be invaluable for tutor sisters and for senior trainees who desire to know something of the details and the reasons for the use of various instruments at different stages of an operation.

Diseases of the Nervous System. By F. M. R. WALSHE, O.B.E., M.D., D.Sc., F.R.C.P. (London); Fourth Edition; 1945. Edinburgh: E. and S. Livingstone. $8\frac{1}{2}'' \times 5\frac{1}{4}''$; pp. 376, with 51 figures. Price: 15s.

THE fourth edition of Walshe's well-known book follows very much the lines of its preceding editions, but more has been included on such recent concepts as psychosomatic illness and the protrusion of intervertebral disks.

The author makes a point of importance when he states that no amount of familiarity with psychological literature will replace the practical acumen of the physician who must distinguish psychogenic from somatic illness and separate the somatic from the psychic part of the same illness. He mentions that in many cases of somatic illness there may be a "top dressing" of psychoneurosis which makes the illness run "not true to form". The various forms of psychoneuroses are abnormal reactions to realities. Anxiety neurosis is a reaction by overaction, the patient developing a form of fear and then a number of psychological and physiological reactions appropriate to these fears. Hysteria, on the other hand, is reaction by underaction—loss of function.

As to sciatica, the author comes to no definite conclusion about the cause, stating that the causes may be multiple. He mentions that many people consider that herniated *nucleus pulposus* is the only cause of sciatica, but that others believe that spondylitis or sacro-iliac joint lesions are also causes. He considers that short single-attack cases of from four to eight weeks' duration are probably due to an interstitial neuritis.

This book, written with the personal views of the author freely expressed, aims at introducing the vast specialized subject of neurology to those outside the few who require more detailed, comprehensive and up-to-the-minute books of reference.

Illustrations of Regional Anatomy (Seven Sections). By E. B. JAMIESON, M.D.; Sixth Edition. Edinburgh: E. and S. Livingstone. $8'' \times 5\frac{3}{4}''$, pp. 332. Price: 75s. net.

THE new and revised sixth edition of "Illustrations of Regional Anatomy" does not differ materially from its predecessor, which was previously reviewed in some detail in these pages (Volume xiii, October, 1943, page 143). Apart from minor alterations and additions to nine of the plates, the new material comprises an index, one new plate showing cross-sections of the mid-brain among its surroundings, and one replacement in which a diagram of the side-wall of the female pelvis has been replaced by a new drawing from an actual specimen.

The selection of material and its clear presentation make the collection eminently suitable to the needs of the student of anatomy. It can be confidently recommended to those making their first acquaintance with the subject and those seeking a rapid and profitable revision. The illustrations may be obtained in seven separate sections or assembled in one bound volume.

A Shorter Practice of Surgery. By HAMILTON BAILEY, F.R.C.S., and R. J. MCNEILL LOVE, M.S., F.R.C.S.; Seventh Edition; 1946. London: H. K. Lewis and Company, Limited. 8½" × 5½", pp. 2005, with 1,063 figures. Price 40s.

THIS book is the product of two prolific surgical authors, who are always happy in their choice of a publisher. All their works—some dozen odd spic and span volumes—are distinguished by flawless production and savour of the traditional surgical teaching of London.

It must surely be gratifying to the authors, and no less a sense of pride must fill the house of Lewis, that since Dunkirk no less than six reprints or new editions have been requested by students of surgery—and that demand has been met. The vignettes, both diagrammatic and actual, by which the value of the book is enhanced, teach more at a glance than many written words. To level one criticism, we ask the authors quite seriously if they have ever employed the Mayo kidney incision as depicted on page 535, or followed their own text for an operation on the kidney. We can, too, be lenient about their description of hydatid disease of the liver, for they cannot be writing from experience.

This "Shorter Practice of Surgery" is not recommended to those reading for a qualifying degree. It is unbalanced. But as a surgical notebook it should find and hold a place in the library of all practitioners who wish to refresh in a moment their memories of almost any surgical disease, however uncommon.

Psychological Medicine. By DESMOND CURRAN, M.B., F.R.C.P., D.P.M., and ERIC GUTTMANN, M.D., M.R.C.P.; Second Edition; 1945. Edinburgh: E. and S. Livingstone. 8¾" × 5¾", pp. 239, with 20 illustrations. Price: 10s. 6d.

IT is probably true to say that psychiatry is one of the branches of medicine that benefit most from warfare, and also true that its various aspects are by no means always recognized by medical officers. This excellent little volume, with all the practical aspects of psychiatry so simply and clearly stated, should do much to help the study of psychiatry both by practitioners and students. Considering the size of the publication, there is a striking amount of information here which reflects great credit on the authors.

One of the most impressive sections of the book is that on the ætiology of mental disorders. Here the authors have collected all the varied factors which may operate, and discuss them critically, warning the reader against the over-emphasis of any particular factor. Thus it is possible for the student to grasp the underlying principles before going on to the more detailed description of the various disorders. As the title of the book states, it is an introduction to psychiatry and, therefore, not a work of reference. The descriptions of the various disorders are fairly short, but long enough to give a clear-cut picture. The one exception to this is the chapter on affective disorders, which lacks the clearness of the rest of the book, even if allowance is made for the difficulty of defining clearly the various types of this reaction. These, after all, constitute the main types that will be a problem for the practitioner rather than the psychiatrist.

Another point is the small amount of space devoted to the visceral neuroses or psychosomatic medicine. In a book that is to be an introduction to psychiatry one cannot help feeling that this important aspect of modern medicine, particularly at present, could have received more emphasis.

However, taken all round, this book fills a long-felt need for those who do not like the lengthy and more abstruse publications on psychiatry. It is well written, adequately illustrated, and should be of the greatest assistance to practitioners and practitioners-to-be.

Proceedings of the Royal Australasian College of Surgeons.

ANNUAL MEETING.

THE annual meeting of the Royal Australasian College of Surgeons was held at Sydney on June 11, 12 and 13, 1946. The inaugural session took place at the Assembly Hall, York Street, Sydney, on June 11, 1946.

President's Address.

The President, H. R. G. Poate, delivered the following address.

The honour falls to me as President of the Royal Australasian College of Surgeons to extend to you a welcome to this inaugural session of our nineteenth annual general meeting.

During the war period we had to forgo our customary ceremonial procedure as so many of our Fellows were either serving abroad or in Australasia with various units of the naval, military and air forces of the British Empire, but we did maintain our interchange of knowledge and experience at general and State or Dominion meetings and through the medium of our AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY. Last year in Melbourne we resumed our old programme, and this is the first post-war meeting in Sydney.

The purposes of our annual general meetings are threefold: firstly, to allow the Council of our College to report on the year's activities to the Fellows of the College; secondly, to allow the College as a whole to demonstrate to you that we are fulfilling the obligations undertaken at the inception of our College; and thirdly, to allow our Fellows an opportunity for scientific discussion and for furthering the advance of surgical art.

This year marks an important stage in our evolution as we commence a new system of admission to the College by examination based somewhat on the method adopted by the Royal College of Surgeons of England with a most important addition that before a candidate is accepted for examination he must prove to the satisfaction of our Censor-in-Chief that he has passed through a period of apprenticeship and training of a standard determined by the College at an approved hospital.

In order to help candidates to qualify for Fellowship the College has approached the major hospitals of our various teaching centres to make available positions under the senior surgeons who will train young men in the science, art and practice of surgery. Facilities for these apprenticeships now exist in all the capital cities, but not yet in all the large Sydney hospitals; however, negotiations now proceeding should prove successful.

In addition the College has instituted regular post-graduate courses in surgery which are open not only to candidates aspiring for our Fellowship, but to others desiring to advance their knowledge or to proceed to higher surgical degrees at our universities. The basic sciences, broadly outlined as anatomy and physiology, requisite for Part I of the examination, are being arranged through the universities, and I am glad to say that the Post-Graduate Committee in the University of Sydney has played a big part in developing these courses as far as New South Wales is concerned, and is also cooperating with the College in providing training requisite for Part II of our examination.

These training activities of the College are particularly important at the present time as there are many brilliant young graduates being demobilized from the armed forces who require some preparation for their reentry to civilian life and work. The war has interrupted that steady flow of young men trained and equipped to take the place of the ageing seniors in the profession; and recognizing that we are under a deep debt of gratitude to them for the years they have given up in the services of the country, we feel we have an obligation to train and to endow them with that experience and knowledge which will permit them to step into our shoes in the near future.

By the adoption of the apprenticeship training and by the nature of the examination required for Fellowship, the general public can be assured that the Royal Australasian College of Surgeons will have the highest standard of training of any of the countries of the world.

The College has this year begun the allocation of Gordon Craig Scholarships, which were held in abeyance during the war years, and has selected four of our young men for training overseas and six for training in Australasia. Further appointments will be made towards the end of this year and again early next year, as more medical officers are demobilized. These scholarships permit not only of training in surgery, but encourage and assist their holders to undertake research work, a matter of great moment to both Australia and New Zealand, owing to the disruption and destruction occasioned in Great Britain and Europe during the war period. This magnificent contribution to improve the status of Australasian surgeons derives from the bequest made by the late Robert Gordon Craig, of this city.

As a result of the award of five Gordon Craig Travelling Scholarships in sterling, a correspondingly greater number of Australian graduates who have served in the armed forces will be able to travel overseas for specialist training as recipients of Nuffield Foundation, Rockefeller Foundation, Carnegie Trust and Australian Red Cross Society scholarships. The last-mentioned scholarships have been provided for immediate post-war years, but the Gordon Craig Scholarships are permanent and will be awarded at half-yearly intervals.

The fact that the Government of New South Wales has announced the formation of a State Research Council, on which this College will be represented, points the way for similar advancement in medical science in other States of Australia and in New Zealand. This body will not interfere in any way with the National Health and Medical Research Council of the Commonwealth, on which the College is also represented, but will aim at the correlation of research in New South Wales and the exploration of particular problems in the health and welfare of the people in this State.

THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY has taken a high place among the world's journals and plays an important role in the dissemination of specialized knowledge and surgical technique.

The establishment of the Gordon Craig Library has filled a great need and we now have access to all the latest surgical periodicals from all over the world, as well as to the most recent textbooks. The historical side of our profession has not been neglected and the acquisition by the College of the Cowlishaw Collection has placed our library in an almost unique position among surgical libraries.

The Royal College of Surgeons of England has always been keenly interested in the development and progress of the Australasian College, and on many occasions has sent representatives to visit us. Arrangements have just been concluded for the Royal College of Surgeons to conduct its Primary Examination in Melbourne, Sydney and Dunedin in January, 1947. During the air raids on London the Royal College suffered serious damage, and in order to help its Restoration Fund the Fellows of our College contributed the sum of £400 sterling from New Zealand and £1,000 sterling from Australia. I feel I must quote a passage from a letter just received from Sir Alfred Webb-Johnson acknowledging the gift:

> The way in which surgeons of Australasia have come forward to help us in our heavy task of restoration will never be forgotten by the Fellows and Members of our College. We hope that our new buildings, when completed, will always be regarded by our colleagues from Australasia as just as much their home as ours.

From what I have said this evening you will see that the College is not only fulfilling the terms of the exordium presented at its inception in upholding and developing the high tradition of our profession, but that we are steadily extending surgical knowledge, providing facilities for the higher education and advanced technical training of specialist surgeons and maintaining the high standard of moral conduct which, in the relation between our Fellows and their patients, is so essential to the safeguarding of the welfare of the community.

The next few years will place a heavy burden on our shoulders, but we have tried to plan so that we can confidently assume the many duties and obligations ahead of us, secure in the knowledge that we have your approbation and goodwill behind us.

George Adlington Syme Oration.

The George Adlington Syme Oration was delivered by Dr. J. H. L. Cumpston on "The Culture of Human Life". The oration is published at page 3.

COUNCIL REPORT.

The following is the report from the Council presented to Fellows at the annual meeting.

Meetings of the Executive Committee.

The Executive Committee has met on twenty occasions. The attendances were as follows:

The Vice-President, Victor Hurley	16
The Censor-in-Chief, W. A. Hailes	16
The Honorary Treasurer, Balcombe Quick	19
Sir Hugh Devine	19
Sir Alan Newton	15
Julian Smith, junior	15
G. R. A. Syme	16

Meetings of the Council.

Three meetings of the Council have been held since the last annual general meeting. The attendances were as follows:

The President, H. R. G. Poate	2
The Vice-President, Professor F. Gordon Bell	1
The Vice-President, Victor Hurley	3
The Censor-in-Chief, W. A. Hailes	3
The Honorary Treasurer, Balcombe Quick	3
E. D. Ahern	1
George Bell	2
Sir Hugh Devine	3
Professor H. R. Dew	2
Sir Henry Newland	2
J. Bruce Hamilton	2
Sir Alan Newton	2

Fellows of the College.

The number of Fellows at the date of this report is as follows:

Honorary Fellows		16
Overseas Fellows		14
New Zealand Fellows		132
Australian Fellows—		
New South Wales	183	
Queensland	43	
South Australia	43	
Tasmania	12	
Victoria	199	
Western Australia	28	
	—	508
		670

Deaths of Fellows.

The Council regrets to report the death of the following Fellows of the College: A. J. Aspinall, F. P. Sandes, W. Vickers (New South Wales), D. P. O'Brien, W. H. Unwin (New Zealand), Sir David Hardie (Queensland), G. A. Hagenauer, H. N. M. Puckle, K. C. Ross (Victoria), M. K. Moss (Western Australia). Letters of sympathy have been forwarded to the relatives.

Association of Surgeons of Great Britain and Ireland.

The Council is pleased to record the honour of Honorary Fellowship of the Association of Surgeons of Great Britain and Ireland bestowed on Sir Alan Newton.

Council.

Sir Henry Newland intimated that he did not desire to accept reappointment to the Council. The Council desires to place on record its great appreciation and gratitude to Sir Henry Newland for the services which he has rendered to the College during his term of office as its President and as a member of the Council.

"The Australian and New Zealand Journal of Surgery."

The Council has been concerned at the fact that issues of THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY have not yet appeared for January and April, 1946. The delay in publication was first caused through a strike in the printing industry and, later, owing to the curtailment of power as a result of a strike on the coalfields. The matter has been taken up on several occasions with the publishers and every endeavour has been made to expedite the publication of the issues of the journal which are in arrear and to ensure that regular publication takes place in the future.

Gordon Craig Library.

The Council desires to record its gratitude to the following donors of books to the library and, in particular, desires to place on record an expression of gratitude to Sir Hugh Lett, C.B.E., for a collection of urological works which he has kindly presented to the Gordon Craig Library. Some of these volumes are of great historical interest. Royal College of Surgeons of England, Sir Alfred Webb-Johnson, Sir Alan Newton, Sir Hugh Devine, H. R. G. Poate, Colonel Moran, Dr. Kenneth McLean, F. P. Morgan, Mrs. J. J. Nattrass, Sir Henry Newland, Dr. H. Graham Ross (Canada), Dr. J. H. Sleeman, Eric Price, Dr. S. O. Cowen, W. G. D. Upjohn, Balcombe Quick, J. T. Tait, Sir Hugh Lett, G. H. Hogg, John H. Shaw.

Election of Council.

Six nominations were received to fill the six vacancies on the Council, and therefore a ballot was not necessary.

Mr. I. B. Jose was elected to fill the vacancy caused by the resignation of Sir Henry Newland.

Number 1 Course of Post-Graduate Training in Surgery.

On March 4, 1946, the first course of post-graduate training in surgery to be conducted by the College began in Melbourne. This course, covering a thirteen weeks' period, is intensive in nature, three lectures per week being held at Prince Henry's Hospital, Melbourne, two lecture-demonstrations per week at the undergraduate teaching hospitals, that is, Royal Melbourne, The Alfred and Saint Vincent's Hospitals, and two lectures per week in surgical pathology. The course has been attended by graduates from New Zealand, Queensland, Victoria and South Australia. It is proposed to conduct these courses at half-yearly intervals.

Gordon Craig Scholarships.

Applications were called for the first award of Gordon Craig Scholarships and as a result twenty applications were received.

After considering the applications in detail, the Council made the following awards: two half-scholarships valued at £200, five full scholarships valued at £400 for work in Australia, and four travelling scholarships valued at £400 sterling.

It is intended, for the time being, to award these scholarships at half-yearly intervals.

Primary Fellowship Examination of the Royal College of Surgeons of England.

Following negotiations with the Royal College of Surgeons of England arrangements have been made to hold the Primary Fellowship Examination of the English College in Australasia. The examination will be held in Sydney, Melbourne and Dunedin early in January, 1947.

Royal College of Surgeons of England, Restoration Fund.

Subscriptions to separate funds were invited from Fellows of the College resident in Australia and in New Zealand for the purpose of making a gift to the rebuilding fund of the Royal College of Surgeons of England. Amounts of £1,000 sterling and £400 sterling have been remitted to the Council of the Royal College of Surgeons of England.

Alteration in Constitution.

At a general meeting of Fellows held in Melbourne on February 27, 1946, the College Articles of Association were amended and, following that meeting, the Council adopted new regulations governing admission to Fellowship of the College. The amendment of the Articles of Association and the adoption of the new regulations were necessary in order to institute the new system of examination for Fellowship of the College.

Later in the year a new handbook and calendar will be published and the new Articles of Association and regulations will be set out therein. In the meantime, any Fellow may obtain a copy of the amended Articles and of the new regulations governing admission to Fellowship on application to the College office.

The Council of the College has laid down the standards required from hospitals seeking approval as suitable hospitals in which aspirants for Fellowship of the College might undergo training. Copies of these requirements and of forms of application to be completed by hospitals seeking the approval of the College may also be obtained on application to the College office.

Herbert Moran Memorial Lecture in Medical History.

The Council of the College desires to record its deep gratitude to one of its Fellows, the late H. M. Moran, who, prior to his death, presented the sum of £1,000 to the College for the purpose of establishing a lectureship in medical history.

Ryan Scholarships in Surgery.

The examinations for the Michael and J. P. Ryan Scholarships were held in March, 1946. The results were as follows:

J. P. Ryan Scholarship in Surgery, awarded to Miss Berta Ungar.
Michael Ryan Scholarship in Surgery, awarded equally to F. X. G. Hurley and D. W. Maginn.

State and Dominion Committees.

The following meetings arranged by the State and Dominion Committees have been or are to be held:

New South Wales:	Evening meeting, February 4, 1946.
New Zealand:	Annual meeting, Dunedin, August 23 and 24, 1945.
Queensland:	Annual meeting, October 10, 1945.
South Australia:	Clinical meetings, June 13 and October 10, 1945.
	Annual meeting, August 15, 1945.
	Clinical meeting, March 13, 1946.
Tasmania:	Annual meeting, Hobart, October 12 and 13, 1945.
Victoria:	Annual meeting, July 20, 1945.
	Half-day meeting, May, 1946.
	Annual meeting, August 2 and 3, 1946.
	Half-day meeting, November, 1946.

Gifts to the College.

The Council desires to record its gratitude to the following donors of gifts to the college: Sir Alfred Webb-Johnson, two rare books for the library; Sir Alan Newton, a microfilm projector and photographic equipment for use in the library; Surgeon Captain Lambert Rogers, autographed photograph; Dr. J. H. L. Cumpston, historical photographs; Julian Smith, senior, portrait of Sir Gordon Gordon-Taylor.

Jacksonian Prize, 1947.

Cabled advice has been received from the Secretary of the Royal College of Surgeons of England that the subject for the Jacksonian Prize for 1947 is "The Surgery of the Lower Œsophagus and Cardiac End of the Stomach".

June 13, 1946. H. G. WHEELER, Secretary.

APPOINTMENT OF STATE AND DOMINION COMMITTEES.

The following appointments were made:

New Zealand: Frank Macky, B. C. Rennie, T. D. M. Stout, P. Stanley Foster, J. A. Jenkins, J. L. Will.

New South Wales: V. M. Coppleson, B. T. Edye, T. M. Furber, J. W. S. Laidley, I. D. Miller, S. L. Spencer, N. R. Wyndham.

Queensland: J. C. Hemsley, A. E. Lee, J. J. Power, A. D. D. Pye, N. G. Sutton, D. M. Yeates.

South Australia: R. M. Glynn, A. F. Hobbs, L. C. E. Lindon, P. S. Messent, B. H. Swift, L. A. Wilson.

Tasmania: F. W. Fay, B. Hiller, D. W. L. Parker.

Victoria: Robert Officer, C. H. Osborn, Henry Searby, C. A. M. Renou, John H. Shaw, Julian Smith, junior, G. R. A. Syme.

Western Australia: J. P. Ainslie, F. J. Clark, L. E. Le Souef.

FINANCIAL STATEMENTS.

The financial statements presented to the Fellows at the annual meeting are published herewith.

ROYAL AUSTRALASIAN COLLEGE OF SURGEONS.

Balance Sheet as at January 31, 1946.

LIABILITIES.	£ s. d.	£ s. d.
General Funds—		
Gift Account	1,580 16 9	
Examination Expenses Reserve Account	579 1 4	
Investment Fluctuation Reserve	83 13 0	
Surplus Account—		
Balance at January 31, 1945 £25,941 4 6		
Add Surplus Revenue for 12 months ended January 31, 1946 1,011 8 7		
	26,952 13 1	
	29,196 4 2	
Creditors—		
Prince Henry's Hospital, Melbourne Post-Graduate Teaching Fund £10 10 0		
Sundry Accounts 20 3 7		
	30 13 7	
Subscriptions Paid in Advance	73 10 0	
		29,300 7 9
Trust Funds—		
T. F. Ryan Endowment Fund £5,100 0 0		
Michael Ryan Scholarship Income Account 114 10 4		
J. P. Ryan Scholarship Income Account 111 6 5		
	5,325 16 9	
Syme Memorial Endowment Fund 2,850 0 0		
Syme Memorial Endowment Income Account 266 13 5		
	3,116 13 5	
Herbert Moran Memorial Lecture Endowment Fund	1,000 0 0	
Royal College of Surgeons, England, Rebuilding Fund	1,192 19 5	
Craig Endowment Fund (as per separate Balance Sheet)	77,568 15 2	
		88,204 4 9
		£117,504 12 6

ASSETS.	£ s. d.	£ s. d.
Account General Funds—		
Building Erected on Leasehold Land at Cost	13,992 5 11	
Furniture and Fittings, at Cost less Depreciation	1,750 0 0	
Great Mace, at Valuation	500 0 0	
		16,242 5 11
Cash at The Union Bank of Australia, Limited—		
Melbourne £257 19 2		
Wellington, New Zealand 739 2 3		
	997 1 5	
Cash on Hand	20 0 0	
Advances to Honorary Secretaries	89 17 10	
Sundry Debtors	71 12 8	
Subscriptions in Arrear	52 10 0	
		1,231 1 11
General Investments		11,826 19 11
		29,300 7 9
Account Trust Funds—		
Investments—		
T. F. Ryan Endowment	5,325 16 9	
Syme Memorial Endowment	3,116 13 5	
Herbert Moran Memorial Lecture Endowment	1,000 0 0	
The State Savings Bank of Victoria—On Deposit, Account Royal College of Surgeons of England, Rebuilding Fund	1,192 19 5	
Craig Endowment Assets, *less* Liability (as per separate Balance Sheet)	77,568 15 2	
		88,204 4 9
		£117,504 12 6

Audited and found correct.
(Signed) YOUNG & OUTHWAITE,
Chartered Accountants (Australia),
368 Collins Street, Melbourne.
March 18, 1946.

(Signed) H. R. G. POATE, President.
(Signed) BALCOMBE QUICK, Honorary Treasurer.
(Signed) H. G. WHEELER, Secretary.

ROYAL AUSTRALASIAN COLLEGE OF SURGEONS. CRAIG ENDOWMENT.

Balance Sheet as at January 31, 1946.

LIABILITIES.	£ s. d.	£ s. d.	ASSETS.	£ s. d.	£ s. d.
Endowment		52,494 3 2	Account Endowment—		
Investment Fluctuation Reserve		141 12 10	Investments	52,585 14 3	
		52,635 16 0	The Bank of Australasia—Endowment Current Account	50 1 9	
					52,635 16 0
Scholarship Fund	16,000 0 0		Account Scholarship Fund—		
Scholarship Income Account	73 12 0		Investments	16,000 0 0	
		16,073 12 0	The Union Bank of Australia, Limited, Income Current Account	73 12 0	
					16,073 12 0
Surplus Account—			Account Surplus and Creditors—		
Balance, January 31, 1945	6,428 6 2		The Union Bank of Australia, Limited, Income Current Account	1,887 0 3	
Add Surplus for the 12 months ended January 31, 1946	2,431 1 0		Gordon Craig Library, at Cost	5,714 3 4	
		8,859 7 2	Library Furniture, Fittings and Equipment, at Cost, *less* Depreciation	1,326 0 0	
		77,568 15 2			8,927 3 7
Sundry Creditors		67 16 5			
		£77,636 11 7			£77,636 11 7

Audited and found correct.
(Signed) YOUNG & OUTHWAITE.
Chartered Accountants (Australia).
368 Collins Street, Melbourne.

March 13, 1946.

(Signed) H. R. G. POATE. President.
(Signed) BALCOMBE QUICK, Honorary Treasurer.
(Signed) H. G WHEELER. Secretary.

HYDATID REGISTRY.

The following is the annual report of the Hydatid Registry of the Royal Australasian College of Surgeons submitted by the Registrar-in-Chief, Sir Louis Barnett.

Summary of Cases.

	Australian Cases.	New Zealand Cases.	Total.
Liver	556	490	1,046
Abdominal and pelvic (peritoneal)	71	58	129
Lung	238	235	473
Muscles and fascia	37	47	84
Bone	13	11	49
Spine	19	6	
Kidney	16	24	40
Spleen	15	9	24
Brain	8	9	17
Heart	4	2	6
Thyreoid	—	2	2
Breast	1	2	3
Pancreas	1	1	2
Parotid	1	—	1
Prostate	—	1	1
	980	897	1,877

From the above tabulation it will be seen that the number of records filed in the Royal Australasian College of Surgeons Library up to March, 1946, amounts to 1877, which may fairly be regarded as a valuable collection of material for clinical and statistical research.

Dr. George Cole, of Geelong, President of the recently established Western Victorian Committee of Hydatid Incidence and Prevention, has devoted a considerable amount of time and energy to a study of these records, which I am glad to learn he has found helpful.

Other inquiries locally and from abroad, foreign as well as British, for statistical and clinical information in the preparation of papers on various aspects of hydatid disease have been received and promptly attended to. It is clear that the Registry is appreciated.

It is, of course, a matter for regret that so large a proportion of the records fail to reach the standard of good case-taking. There are far too many errors of omission, due no doubt mainly to insufficient time, but in some cases, I am sorry to say, to slackness on the part of the house surgeons and inadequate supervision by their registrars. Moreover, the operating surgeons themselves are often to blame for not taking enough interest in the way their cases are recorded. As I have said on former occasions, improvement in clinical results depends greatly on the training of the juniors in adequate and accurate case-taking. It is to be hoped that now that the chief stress of war is past both the quantity and quality of the records will improve and that increasing use will be made of them by Australian and New Zealand practitioners when writing articles for publication.

During the year a gratifying contribution of records collected by Dr. B. Hiller, the State secretary, came from Tasmania. Dr. Muir, of Hobart, figured prominently in this list with fourteen cases. Dr. Hiller tells me that with a view to stimulating the recording of hydatid cases the Tasmanian State Committee has appointed Mr. C. Craig, surgeon-superintendent of the Launceston General Hospital, as State Registrar.

Victoria, with the assistance of Mr. G. R. A. Syme and Mr. Julian Smith, junior, and New South Wales, under the watchful care of Professor Dew, have kept up a small but steady supply of records; and as regards the New Zealand contributors special mention is due to Mr. C. H. North, of the Palmerston Hospital, and Mr. R. S. A. Graham, of Waikato, for their regular and valuable contributions.

Thanks are accorded to all who have helped in the supply of records, and in particular I wish to mention the names of our Secretary, Mr. H. G. Wheeler, and his assistants, Miss Andrew and Miss Oldham.

L. E. BARNETT,
Registrar-in-Chief,
Hydatid Registry.